QUALITY OF CURRENT ISCHAEMIC STROKE CARE PRACTICES IN THE CAPE METRO HEALTH DISTRICT, SOUTH AFRICA

Vimbai
Mandizvidza
(MNDVIM001)

DISSERTATION in PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE MASTERS OF PUBLIC HEALTH
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Supervisors
Professor Leslie London
Professor Alan Bryer

School of Public Health and Family Medicine
University of Cape Town
And
Division of Neurology, Department of
Medicine Groote Schuur Hospital

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DECLARATION

I, **Vimbai Mandizvidza**, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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Date: 14 August 2017

Dedication

For Baba na Amai Mandizvidza and my siblings; Tonderai, Lynn Rudo and Nyasha.

You are always on my side

Abstract

The aim of this study was to assess the acute and post-acute services for ischaemic stroke patients in the Cape Metro Health District in relation to the South African ischaemic stroke guideline.

Part A: Protocol

The protocol outlines the purpose of the study and highlights the importance of conducting this study by analysing the literature on stroke care in both high and low and middle income countries. The literature also highlights the gaps in stroke care in South Africa which justify the need for this study. The protocol also outlines the methods of data collection and analysis as well as the ethical considerations.

Part B: Literature Review

This expands on the literature on the different components of both acute and post-acute stroke care in both high and low and middle income countries. It also elaborates on stroke in South Africa and why it is important to conduct this study.

Part C: South African Medical Journal manuscript

The manuscript summarises the whole study and includes the literature on stroke care, justification of the study and how the data was collected and analysed. The manuscript also includes the results obtained and sections on the discussion and conclusions.

Acknowledgements

I would like to thank;

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- The Provincial Department of Health and different hospital administrations in the Cape Metro Health District for allowing me to do this study.
- The doctors and nurses who took time out to participate in this study.

PART A: PROTOCOL

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1.1 Purpose of the study

1.2 Aims

To assess the acute and post-acute services for ischaemic stroke patients in the Cape Metro Health District in relation to the South African ischaemic stroke guideline over the period 2016 to 2017.

1.3 Objectives

i. To describe the acute and post-acute ischaemic stroke services offered to ischaemic stroke patients in level 1, 2 and 3 hospitals in the Cape Metro Health District
ii. To compare the acute and post-acute ischaemic stroke services offered to patients with ischaemic stroke against the South African ischaemic stroke guidelines
iii. To identify any barriers to optimum patient care encountered by the health facilities in providing the acute and post-acute ischaemic stroke care services

2.0 Background

Strokes are an important global cause of disability and premature death in adults (Brainin et al., 2007, Mohd Nordin et al., 2014). In 2010, globally, strokes were responsible for approximately 5.9 million deaths, 33 million prevalent cases and 102.2 million Disability Adjusted Life Years (DALYs) lost, of which 71%, 52% and 78%, respectively, were from Low and Middle Income Countries (LMIC) (Feigin et al., 2014). Unlike in the high income countries where strokes affect particularly the elderly, in LMIC, a substantial proportion of the economically active younger populations are affected and this has significant adverse effects on the health the populations as well as the economies of these countries (Strong et al., 2007). Therefore, strokes in LMIC are an important health as well as economic concern.

Strokes in South Africa are also a significant public health problem. According to Statistics South Africa, in 2013, cerebrovascular diseases were ranked fourth in the top ten leading causes of death in South Africa after Tuberculosis, the respiratory infections; Influenza and pneumonia, and Human Immunodeficiency Virus (HIV). Cerebrovascular diseases accounted for approximately 4.9% of deaths in South Africa (Statistics South

Africa, 2015).

Strokes can be broadly classified into two categories; haemorrhagic and ischaemic. The difference between the two categories is in their mechanism of action. A haemorrhagic stroke results from the rupture of a weakened blood vessel which causes bleeding into and around the brain. An ischaemic stroke occurs as a result of a clot or embolus obstructing blood flow in the brain. Ischaemic strokes are the most common and comprise approximately 87% of cases (Summers et al., 2009). This study in the Cape Metro Health District will focus on some components of the medical management and care of the more common ischaemic strokes.

In the acute phase of care, an important objective in managing an ischaemic stroke involves maintaining homeostasis through active management of the physiologic abnormalities such as dehydration, hypoxia, hypoglycaemia and abnormal blood pressures. Other important objectives include the prevention of complications as well as implementing strategies to re- establish perfusion of the brain (Bryer et al., 2010). This latter objective can be accomplished with the use of drugs such as tissue plasminogen activator that break down the clot or emboli. In some cases, endovascular procedures that physically break down the clot can be performed. These interventions have been found to have significant positive effects on patient outcomes when delivered in a stroke unit model of care by a dedicated multidisciplinary team (MDT) (Dennis and Langhorne., 1994).

A stroke unit is a geographically defined area in the ward or hospital where stroke patients are managed by a MDT (de Villiers et al., 2009). The MDT of healthcare professionals includes doctors, nurses, physiotherapists, occupational and speech therapists, dieticians, social workers and psychologists (Bryer et al., 2010). Ongoing training of this team is essential so that they remain coordinated and organized. Apart from the MDT, another unique feature of the stroke unit concept is the education of the patient and their caregivers on strokes; this includes information about the complications that may arise, secondary prevention and care that should be given at home. The early involvement of the patient and their caregivers in the treatment and rehabilitation process helps with the continuation of care when the patient is discharged home.

Stroke patients managed in stroke units have been found to have better outcomes compared

to those not managed in stroke units (Indredavik et al., 1991, Kalra et al., 2005, Langhorne et al., 1993, Stroke Unit Trialists' Collaboration, 1997, Sun et al., 2013). In one of the earlier trials conducted between 1986 and 1987 at a local university hospital in a town in Norway, 220 stroke patients were randomly allocated into those managed in a stroke unit and those managed in general medical wards (Indredavik et al., 1991). The participants in this study included a mix of ischaemic and haemorrhagic strokes; however, the distribution of the different diagnoses was similar in the 2 groups. Outcomes in the study measured at 6 and 52 weeks were to determine mortality, the functional state of the participants and the proportion of participants living at home and those living in an institution.

The log-rank test was used to compare the 2 groups; stroke unit and general medical ward. In the intention to treat analysis at 6 weeks, the proportion of participants who had died or were living in an institution was lower in those managed in the stroke unit compared to those managed in the general medical ward (p values of 0.027 and 0.02, respectively). At 6 weeks, the proportion of those who had died was 7.3% for the stroke unit compared to 17.3% for the general medical ward and the proportion of those living in an institution was 36.3% for the stroke unit and 50% for the general medical ward. The proportion of those living at home was 56.4% for those managed in the stroke unit and 32.7% for those managed in the general medical ward, and this was also statistically significant (p = 0.0004). The results at 52 weeks were similar to those found at 6 weeks. Those participants managed in the stroke unit had a statistically significant persistently higher functional state (mean neurological score) compared to those managed in the general medical ward when measured at both 6 and 52 weeks (p values 0.007 and 0.004 respectively).

In summary, the study found that patients managed in a stroke unit are more likely to be alive and living at home as well as have a higher functional state which allowed them to be less dependent on caregivers when compared to patients managed in the general medical wards. However, the absence of blinding was an important weakness noted in this study which could have introduced observer bias and influenced the results of the study.

Similar results were obtained in a single blinded randomized control trial conducted more than a decade later in England by Kalra et al in 2005. In this study, stroke patients managed by an MDT in a stroke unit were compared to those receiving home based care by a specialist home based team and those managed in general medical wards with

support from a stroke team. Participants were recruited from the stroke register and from the 979 on the register, 457 were randomised into the three groups; acute stroke unit, general medical ward and home based care.

The main outcomes of the trial were institutionalisation or death at 1 year. The trial found that there were fewer deaths and cases of institutionalisation at 1 year in those patients managed in the acute stroke unit (13.5%) compared to those managed in the general medical wards (30.2%) and also compared to those who received home based care (23.6%). At 1 year, those managed in the stroke unit were found to have a 54% reduced relative risk of dying or being institutionalised compared to those who were managed by the stroke team in the general medical wards (RR 0.46 [95% CI 0.3-0.72], p =0.001). The study also found that at 1 year, those managed in the stroke unit had a 41% reduced relative risk of dying or being institutionalised compared to those managed by the specialist home based team (RR 0.59 [95% CI 0.37-0.95], p = 0.03) (Kalra et al., 2005). In this study, stroke patients managed in a stroke unit were found to have better outcomes compared to those managed at home and those managed in the general medical wards.

The results of the Cochrane Stroke Group systematic review conducted in 2013 were consistent with the results of the previous studies. The systematic review included 28 randomized control trials which resulted in a total of over 5000 participants. The outcomes of stroke patients managed in stroke wards, mixed rehabilitation wards and general medical wards and those managed by a mobile stroke team were all compared. At 1 year, patients managed in acute stroke units were found to be less likely to die, be dependent or require institutionalized care with odds ratios 0.81 (95% CI 0.69-0.94), 0.79 (95% CI 0.68-0.9) and 0.78 (95% CI 0.68-0.89), respectively, compared to those stroke patients managed in general medical wards (Cochrane Stroke Group, 2013). Overall, the results comparing the organised stroke unit care to the less organised alternatives found that stroke units had favourable effects on the outcomes of stroke patients.

These studies were conducted in high income countries and this led to debates about whether it was feasible to have stroke units in resource limited LMIC and achieve patient benefit. This question led to a small before-after study being conducted in a secondary hospital in South Africa (de Villiers et al., 2009). The study was conducted over 6 months; in the first 3 months, data was collected on patients who were managed in the

general medical wards, and the second half of the study took place after the new stroke unit was set up. Patient outcomes for those managed in general medical wards were then compared to outcomes of those managed in the newly established acute stroke unit. Although the study had a small sample size of only 195 participants, the researchers found that a stroke unit could be established in a low resource setting with little impact on cost. The study also found that in-patient mortality was reduced in the stroke unit compared to the general medical ward, a reduction from 33% in the general medical ward to 16% in the stroke unit ($p = 0.005$). Though the study was small, participants not matched and the study duration short, the results suggested that positive patient outcomes could potentially be achieved from stroke units in poor resource setting.

In summary, the evidence indicates that the acute and post-acute care of stroke patients by a MDT in a stroke unit results in favourable outcomes for stroke patients. There is also evidence to suggest that it is possible to set up these stroke units in resource poor settings and achieve benefits for the patients. The establishment of stroke units in LMIC such as South Africa can potentially have a positive impact on patient outcomes, reducing disability and morbidity rates.

The evidence from studies such as these contributed to the development of the current South African guideline on the management of ischaemic strokes (Bryer et al., 2010). This guideline outlines the acute and post-acute management of ischaemic stroke patients including the components of an acute stroke unit and the minimum requirements for the different level of hospitals found in South Africa. However, since these national guidelines were established, no evaluation has been conducted on the services offered to ischaemic stroke patients in the country. This is all the more relevant as the quality of acute and post- acute care services are likely to affect patient outcomes after stroke.

Therefore, the aim of this study is to evaluate the acute and post-acute care services for ischaemic stroke patients offered at level 1, 2 and 3 hospitals in the Cape Metro Health District and identify barriers to optimum stroke care in these hospitals. Using this information, cost effective models suitable for these hospitals may be recommended to overcome these barriers and optimize stroke care. Table 1 below shows the components of acute and post-acute stroke care services reflected in the

guidelines.

3.1 Methodology

3.2 Study design

This will be a descriptive study comprised of semi-structured interviewer administered questionnaires, audits of hospital stroke management and a record review of ischaemic stroke patient discharge summaries.

Table 1: Summary of the components of acute and post-acute stroke care used to assess quality in this study

The components of acute and post-acute ischaemic stroke care used to assess the quality of care as per the South African guidelines
1. Stroke unit – the presence of a geographically defined area in the hospital with dedicated beds for the management of stroke patients.
2. Protocols for acute and post-acute management of stroke that focus particularly on the active management of physiological abnormalities to maintain homeostasis in ischaemic stroke patients.
3. The presence of a MDT that conducts combined rounds. The MDT includes a medical doctor specialised or with a special interest in stroke care, nursing staff and at least one physiotherapist, occupational therapist, speech and language therapist, social worker, dietician and psychologist. The different health professionals that comprise the MDT will differ depending on the level of the hospital; secondary, regional or tertiary.
4. Continued medical training on stroke care for all the health workers involved in the management of ischaemic stroke patients.
5. Education of the patient and his/ her family on the causes and management of ischaemic stroke, both as an in-patient and out-patient.
6. The use of the thrombolytic recombinant tissue plasminogen activator (rt-PA) for the management of ischaemic strokes at level 2 and 3 hospitals.
7. The use of medication such as aspirin and drugs for hyperlipidaemia, hypertension and diabetes mellitus for secondary prevention.

The semi-structured questionnaires will be administered through face to face interviews with health professionals who work in the sample of nine level 1, 2 and 3 hospitals in

the Cape Metro Health District. The study will be conducted in these hospitals because they have in- patient facilities and have the capacity to admit ischaemic stroke patients.

After the face to face interviews have been completed, a retrospective review of data from computerized hospital patient discharge summaries will be used to describe the characteristics of patients, aged 18 years and older, admitted with ischaemic strokes at Groote Schuur Hospital, Cape Town from the 1st of August 2016 to the 31st of January 2017. Only Groote Schuur Hospital patient discharge summaries will be used in this study because it has the most complete and accurate patient discharge summaries compared to the other hospitals.

Table 2: Level 1, 2 and 3 hospitals in the Cape Metro Health District

Level 1 (District)	**Level 2 (Regional)**	**Level 3 (Tertiary)**
• Eerste River Hospital • False Bay Hospital • Karl Bremer Hospital • Khayelitsha Hospital • Mitchell's Plain Hospital • Victoria Hospital	• New Somerset Hospital	• Groote Schuur Hospital • Tygerberg Hospital

3.3 Study population

The study population includes level 1, 2 and 3 hospitals in the Cape Metro health district. A sample of all 9 hospitals will be included in the study; six level 1 hospitals, one level 2 hospital and two level 3 hospitals. Table 2 above shows the list of the hospitals in the Cape Metro Health District that will be included in the study.

3.4 Data collection

All the data will be collected by the researcher, over a period of 10 weeks. From the 7 level 1 and 2 hospitals that have been included in the study, 3 health professionals involved in the management of ischaemic stroke patients will be randomly selected from each health facility. The 3 health professionals will include; a medical doctor who works in the emergency department and a medical doctor and a nurse who manage ischaemic stroke patients in the internal medicine wards. From the 2 level 3 hospitals included in the study, 5 health professionals involved in the management of ischaemic stroke patients will be randomly selected from each hospital. The 5 health professionals

will include a medical doctor and a nurse who manage ischaemic stroke patients in the internal medicine wards, a doctor and a nurse who manage ischaemic stroke patients in the stroke units and a doctor who works in the emergency department.

These randomly selected health professionals will be invited to participate in face to face interviews. The interviews will be conducted in English by the researcher at their respective health facilities. The participants will be interviewed one at a time in a comfortable secluded area and only one interview will be conducted for each participant. The interviews will be recorded using a digital audio recorder and questionnaire forms. The responses from the open ended questions will be transcribed from the digital audio recordings after the interviews and the responses from the closed ended questions will be filled out in the questionnaires during the interviews.

The questionnaires that will be used during the semi-structured interviews with the doctors and nurses are attached in Appendix 3. These questions were designed to assess the different components of acute and post-acute ischaemic stroke care as contained in the national stroke guidelines and as listed in table 1. The responses from these questionnaires will be used to determine the quality of ischaemic stroke care in the different hospitals in the Cape Metro Health District. The interviews will also elicit information on any barriers to optimum care the medical doctors and nurses may encounter during their practice. The health professionals will also be given the opportunity during the interviews to give their suggestions on how these barriers to optimum stroke care could be overcome.

Table 3 below shows the list of components that will be used to assess quality of acute and post-acute stroke care services in the level 1, 2 and 3 hospitals and also which of the components will be covered in the questionnaires with the different health professionals in assessing the presence, absence or degree of compliance to these components.

After the semi-structured face to face interviews with the health professionals have been conducted at a particular hospital, an audit of the hospitals stroke management will be performed using the audit forms in Appendix 4 to verify some of the information that would have been provided during the interviews. These audit forms were adapted from the South African national stroke guidelines and contain the

minimum requirements for the different level of hospitals found in South Africa. There are 3 audit forms and these were specifically designed for the 3 different hospital levels.

After the interviews and hospital audits have been completed, clinical data on 96 ischaemic stroke patients admitted at Groote Schuur Hospital during the period from the 1st of August 2016 to the 31st of January 2017 will be collected in a retrospective review of discharge summaries. The sample size of 96 ischaemic stroke patients is based on the anticipated prevalence of adherence to guidelines of 50%, 95% confidence interval and a precision of 10%.

Table 3: The list of components that will be used to assess quality of acute and post-acute stroke care services in the level 1, 2 and 3 hospitals and which health professional will have questions directed towards assessing the component

Components of acute and post –acute stroke care service to be used in this study	**Medical doctor (Ward)**	**Medical doctor (Emergency unit)**	**Nurse (Ward)**
1. Stroke unit – the presence of a geographically defined area in the hospital with dedicated beds for the management of stroke patients	•	•	•
2. Protocols for acute and post-acute management of stroke with special attention to active management of physiological abnormalities to maintain homeostasis	•	•	•
3.1. The presence of a MDT that conducts combined rounds. 3.2. The MDT includes a medical doctor specialised or with a special interest in stroke care, nursing staff and at least one physiotherapist, occupational therapist, speech and language therapist, social worker, dietician and psychologist (this will depend on the health facility)	•		•
4. Continued medical training on stroke care for all the health workers involved in the management of stroke patients	•		•
5. Education of the patient and his/ her family on the causes and management of the stroke, as an in-patient	•		•

6. The use of the thrombolytic recombinant tissue plasminogen activator (rt-PA) for the management of ischaemic strokes at level 3 hospitals	•	•	
7. The use of medication such as aspirin and drugs for hyperlipidaemia, hypertension and diabetes mellitus for secondary prevention	•		•

Approximately 450 stroke patients are admitted at Groote Schuur hospital annually. Studies have found that ischaemic strokes are the most common, contributing about 87% of cases, therefore, approximately 392 ischaemic stroke patients are admitted to Groote Schuur Hospital annually or about 196 ischaemic stroke patients in 6 months. Assuming that not all patients will have discharge summaries that are easily available, some patients will be under 18 years of age and other discharge summaries will be excluded based on the other exclusion criteria, 96 folders can be obtained for review over a 6 month period.

Therefore, 96 selected patients who are 18 years and older admitted with a diagnosis of ischaemic stroke at Groote Schuur Hospital during the period from the 1st of August 2016 to the 31st of January 2017 will be recruited. If the number of eligible discharge summaries is less than 120 but more than 96, all the discharge summaries will be included. If the number of ischaemic stroke patient discharge summaries available is more than 120, a sample of 96 will be randomly selected in proportion to the number of cases by month.

Patients will initially be identified using the nurse's patient admission record book. The names and hospital numbers of all the patients with a provisional or definitive diagnosis of stroke admitted in both the acute stroke unit and the medical wards during the specified 6- month period will be collected. From this list, the patients' computerized hospital discharge summaries will be reviewed and only those stroke patients found to have had an ischaemic stroke will be included. The conclusion that a patient had an ischaemic stroke ischaemic stroke will be based on the clinician's management and diagnosis in the patient discharge summaries. In cases where a patient has had recurrent strokes during the study period, only the first admission occurring within the stated 6-month period will be included in the study. Variables that will be collected during the review of computerized stroke patient discharge summaries are

listed in table 4 below and in appendix 5.

No interviewee names will be attached to the questionnaires or recorded on the digital audio recorder. Confidentiality and anonymity will be maintained through the removal of personal identifiers. For the clinical data, unique patient identifiers will be generated for the list of ischaemic stroke patients collected. The list of names and hospital numbers of the ischaemic stroke patients will be kept in a password protected computer file separate from the clinical data collected and all this information will be accessible only to the researcher.

Table 4: Description of the variables to be used in the review of ischaemic stroke patient discharge summaries

Variable	**Description of variable**
1. Age	Age will be recorded in years and it will be the age of the patient at the time of admission
2. Gender	Male or female
3. Duration of admission	Duration of admission will be recorded in days and these will be counted from the first day of admission
4. Admitting ward	Admitting wards are either the acute stroke unit or the medical ward
5. Co-morbidities	The co-morbidities that will be searched for specifically are hypertension, diabetes mellitus and hyperlipidaemia
6. Mandatory laboratory investigations	These investigations should be conducted in every ischaemic stroke patient: i. Full blood count (FBC) ii. Urea and electrolytes (U + E) iii. Creatinine iv. Random blood sugar (RBS) or glucometer reading v. Erythrocyte Sedimentation Rate (ESR) or C-reactive protein (CRP)
7. Other mandatory investigations	These investigations should be conducted in every ischaemic stroke patient: i. Electrocardiogram (ECG) ii. Chest x-ray (CXR)
8. The use of recombinant tissue plasminogen activator (rt-PA)	Documented use of rt-PA in the patient
9. The use of medication	i. Aspirin

such as aspirin and drugs for diabetes mellitus, hypertension and hyperlipidaemia for secondary prevention	ii. Anti-hypertensive and hypoglycaemic medication and drugs for hyperlipidaemia prescribed for patients with hypertension, diabetes mellitus and hyperlipidaemia respectively
10. Discharge	Where the patient was discharged to; i. Home ii. An institution. If the patient was discharged to an institution, whether it was a hospital, rehabilitation centre or a hospice

3.4.1 Inclusion criteria

Health professionals with a minimum of six months experience in managing ischaemic stroke patients in their respective departments at the particular hospital will be invited to participate in the face to face interviews. It will be assumed that a doctor or nurse working for at least 6 months in the emergency unit or on a ward that admits ischaemic stroke patients has experience managing stroke patients.

For the clinical data collection, only ischaemic strokes will be considered for this study. For an ischaemic stroke patient discharge summary to be included in the study, the patient will need to been admitted at Groote Schuur Hospital with indications of having suffered an ischaemic stroke or have a diagnosis of ischaemic stroke during the period between the 1st of August 2016 and the 31st of January 2017. For stroke patients with recurrent strokes during the 6-month period under study, only the first admissions during the specified period will be considered. Adult patients, 18 years and older at the time of admission, will be included.

3.4.2 Exclusion criteria

For the face to face interviews, the health professionals with less than 6 months experience in their respective departments at that particular hospital will be excluded from the study.

For clinical data collection, a patient with a haemorrhagic stroke, transient ischaemic attack or other neurological condition besides ischaemic stroke will be excluded from the study. Patient discharge summaries with insufficient detail on the type of stroke will also be excluded. Patients who are younger than 18 years of age at the time of admission

will be excluded from the study.

3.5 Data analysis

The data from the interviews, hospital audits and the review of ischaemic stroke patient discharge summaries from Groote Schuur Hospital will initially be analyzed separately. Thematic coding and analysis will be used for the data obtained from the interviews and hospital audits, and the coding for the discharge summaries has been outlined in appendix 5.1. The results obtained will then be compared to the minimum requirements listed in the audit forms in appendix 4, depending on whether the hospital is a level 1, 2 or 3 hospital. If responses from a questionnaire contradicts the results from an audit, more weight will be given to the results of the audit as these will be more objective compared to the questionnaire responses. Comparing the current acute and post- acute ischaemic stroke services offered in the different hospitals against the South African ischaemic stroke guidelines will help in determining the quality of stroke care services offered. These minimum requirements listed in appendix 4 were adapted from the South African guidelines for the management of ischaemic stroke. Table 5 below shows how the quality of ischaemic stroke care will be assessed for each of the components of stroke care that will be used for this study.

For the numerical data; means and standard deviations or medians and inter-quartile ranges will be used to summarize the data and the decision about which measures are used will be determined by the distribution of the data. Categorical data will be summarized using frequency tables. Patterns in the data will be analysed using box and whisker plots, histograms and bar graphs.

Table 5: How the quality of ischaemic stroke care will be assessed for each of the components of stroke care that will be used for this study

The components of acute and post-acute ischaemic stroke care used to assess the quality of care	**Description of how quality will be assessed**
1. Stroke unit – the presence of a geographically defined area in the hospital with dedicated beds for the management of stroke patients.	The presence of hospital beds dedicated specifically for stroke patients will be classified as fulfilling the requirements.
2. Protocols for acute and post-acute management of stroke that focus particularly on the active management of physiological abnormalities to maintain homeostasis in ischaemic stroke patients.	When written protocols are available on the ward and in the emergency department and these protocols include information on the active management of physiological abnormalities to maintain homeostasis in ischaemic stroke patients, this will be classified as fulfilling the requirements.
3. The presence of a MDT that conducts combined rounds. The MDT includes a medical doctor specialised or with a special interest in stroke care, nursing staff and at least one physiotherapist, occupational therapist, speech and language therapist, social worker, dietician and psychologist. The different health professionals that comprise the MDT will differ depending on the level of the hospital; secondary, regional or tertiary.	The combinations of health professionals in the MDT will depend on the level of the hospital. The hospitals meeting the minimum staff requirements for a MDT for their particular hospital level will be classified as fulfilling the requirements.
4. Continued medical training on stroke care for all the health workers involved in the management of ischaemic stroke patients.	The hospitals which have at least one tutorial meeting a week involving the management of ischaemic stroke patients as stated by the doctors and nurse during the interviews will be classified as fulfilling the requirements.
5. Education of the patient and his/ her family on the causes and management of ischaemic stroke, both as an in-patient and out-patient.	The hospitals where there is evidence of patient and care giver education in the form of a checklist of topics that are discussed during these meetings will be classified as fulfilling the requirements.
6. The use of rt-PA for the management of ischaemic strokes at level 2 and 3 hospitals.	Documentation of the use of rt-PA in the ischaemic stroke patient discharge summaries will be classifies as fulfilling the requirements.

7. The use of medication such as aspirin and drugs for hyperlipidaemia, hypertension and diabetes mellitus for secondary prevention	i. In the interviews, if the doctors and nurses mention that during the discussions with the patients and caregivers, they discuss the use of medication in secondary prevention of an ischaemic stroke; this will be classified as fulfilling the requirements. ii. In the review of patient discharge summaries, the presence of a prescription for aspirin and/or medications for hypertension, diabetes mellitus or hyperlipidaemia will be classified as fulfilling the requirements.

Any associations between 2 numerical variables will be tested using Pearson's correlation coefficient or Spearman rank correlation, the test used will depend on the underlying distributions of each variable. The Chi-squared test or Fisher's exact test will be used to test for any associations between categorical variables; the choice of test used will depend on the value of the expected frequencies in the cells of the contingency tables. Analysis of the data will be conducted using the statistical software STATA, version 14 (StataCorp. 2015).

3.6 Limitations

One of the limitations of this study is that some of the data relies heavily on what the health professionals say during the interviews. Some of the data can be verified using the hospital audits and patient discharge summaries but for some of the components of stroke care, only the responses made during the interviews will be used in the analysis.

If there is missing data in the patient discharge summaries, the researcher will not seek to fill in information that is missing but will only use what is in the summaries during the analysis. When data is missing for a particular variable, that specific patient will be excluded from the analysis that includes that particular variable.

3.7 Timeline

The timeline for the research study is summarized in table 6 below.

Table 6: Timeline for research project

Activities	Feb – Sept	Nov 201	Dec 2016	Jan 2017	Feb 2017	March 2017	April 201	May 201	June 201
Protocol									
Data collectio									
Data analys									
Literatu re									
Journ al									
Submission									

3.8 Budget

The budget for this research project is summarized in table 7 below.

Table 7: Budget for the research project

Item	Description	Cost (ZAR)	Quantity	Total cost (ZAR)
Stationery	1. Protocol	0.5/ page	69 pages (3 copies)	**34.50**
	2. Participant information forms	0.5/ page	15 pages	**7.50**
	3. Consent forms	0.5/ page	30 pages	**15.00**
	2. Interview transcripts	0.5/ page	300 pages	**150.00**
	3. Audit forms	0.5/ page	15 pages	**7.50**
	4. Data collection forms	0.5/ page	10 pages	**5.00**
	4. Literature review	0.5/ page	30 pages	**15.00**
	5. Journal article	0.5/ page	7 pages	**3.50**
	6. Binding	40/ copy	3	**120.00**
Data storage	USB drive	150	1	**150.00**
Transport	Travel expenses			**1000.00**
TOTAL				**1508.00**

4.1 Ethical considerations

4.2 Ethical review

Approval for the study will be obtained from the University of Cape Town Human Research Ethics Committee (UCT-HREC) in the Faculty of Health Sciences. Additional approval will be obtained from the Western Cape Department of Health and the level 1, 2 and 3 hospitals in the Cape Metro Health District that will be included in the study.

4.3 Risks

This is a minimal risk study for the health professionals participating in the study. Every effort will be made to make the participants comfortable during the interviews. For the clinical data collection using the patient discharge summaries, there will be no direct contact with the stroke patients; information will be extracted from the computerised hospital patient discharge summaries. Hospitals that are found to not be adhering to the national guidelines will not incur any penalties.

With both the interviews and review of discharge summaries, there is a risk of loss of confidentiality. However, no personal information of the participants or patients will be attached to the data during analysis or be published in the thesis or any other publications that will ensue from it. In addition, all the questionnaires, consent forms, recordings and data collection forms will be stored in a locked cupboard in the postgraduate room 5th Floor Falmouth Building at the University of Cape Town Health Sciences campus and any data stored in computer files will be password protected. The list of names and hospital numbers of the stroke patients will be kept in a password protected computer file separate from the clinical data collected in the data collection forms and will be accessible only to the researcher.

4.4 Benefits

After all the interviews for a particular health facility have been completed, the health professionals interviewed will be provided with information on the current South African stroke guidelines. The stroke patients whose discharge summaries will be reviewed will not benefit directly from this study however the information obtained might help to improve quality of care delivered which may also improve

patient outcomes.

4.5 Compensation

The health professionals who will participate in the face to face interviews will not receive any compensation.

4.6 Informed consent

Informed consent will be obtained from the participants who will be invited to take part in the interviews. The participants will be informed about the objectives of the study, the benefits and the potential risks of taking part in the study and the measures that have been put in place to minimize these risks. They will also be informed that participating in the interviews is voluntary and if they were to choose not to continue participating at any time during the interview, there will not be any consequences for taking such an action. No consent will be sort from the patients whose discharge summaries will be reviewed as there will be no direct contact with these patients.

4.7 Privacy and confidentiality

There will be no personal identifiers attached to the questionnaires, audio recordings or data collection forms. The researcher will not collect any personal information such as names and addresses from the study participants during the interviews. The patient names and hospital numbers collected for the review of discharge summaries will be kept separate from the data collection forms and only the researcher will have access to them.

All the questionnaires, the list of patient names and hospital numbers, data collection forms and consent forms will be kept in a locked cupboard at the University of Cape Town Health Sciences campus and any data stored in computer files will be password protected computer. Responses of participants who will be interviewed will be reported anonymously so that it will not be possible to match an individual's response to a particular health facility.

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PART B: LITERATURE REVIEW

Table of Contents

1.1 Introduction

Strokes are an important cause of disability in adults and the second leading cause of death globally (Brainin et al., 2007, Mohd Nordin et al., 2014). They are a global public health problem and focusing on prevention strategies as well as good quality stroke care is important.

This is a brief analysis of the literature available on stroke care in different settings around the world with a focus on low and middle income countries (LMIC). Analysing the literature on stroke care in other LMIC can assist in describing the type and understanding the quality of stroke care in the different hospitals in the Cape Metro Health District in Cape Town, South Africa.

In 2010, the South African guideline for the management of ischaemic stroke (Bryer et al., 2010) was published and this outlined the components of care recommended at the different hospital levels. Although the national guideline has been in place since 2010, it is unclear as to the extent to which the guideline has been implemented in the hospitals, if at all.

Publications for this literature review were found using Pubmed, Cochrane, Google scholar and Scopus. The following keywords were used “acute cerebrovascular accident” OR “stroke” OR “cerebral stroke” OR “cerebrovascular stroke” OR “little stroke” OR “brain attack” OR “acute cerebral accident” OR “ischaemic stroke” OR “ischemic stroke” AND “care” OR “management” OR “treatment” OR “rehabilitation” AND “low and middle income countries” OR “third world countries” OR “developing countries”.

1.2 Definitions

The World Health Organization clinical definition of stroke is "rapidly developing signs that result from a focal or global disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death with no apparent cause other than of vascular origin" (Krishnamurthi et al., 2014, Norrving and Kissela, 2013).

Strokes can be broadly classified into ischaemic and haemorrhagic. Ischaemic strokes are caused by thrombi or emboli obstructing the blood vessels supplying the brain. They are the most common, accounting for 87% of all strokes (Summers et al., 2009). Haemorrhagic strokes are less common and result from rupturing of weakened blood

vessels which cause intracranial bleeding (Summers et al., 2009).

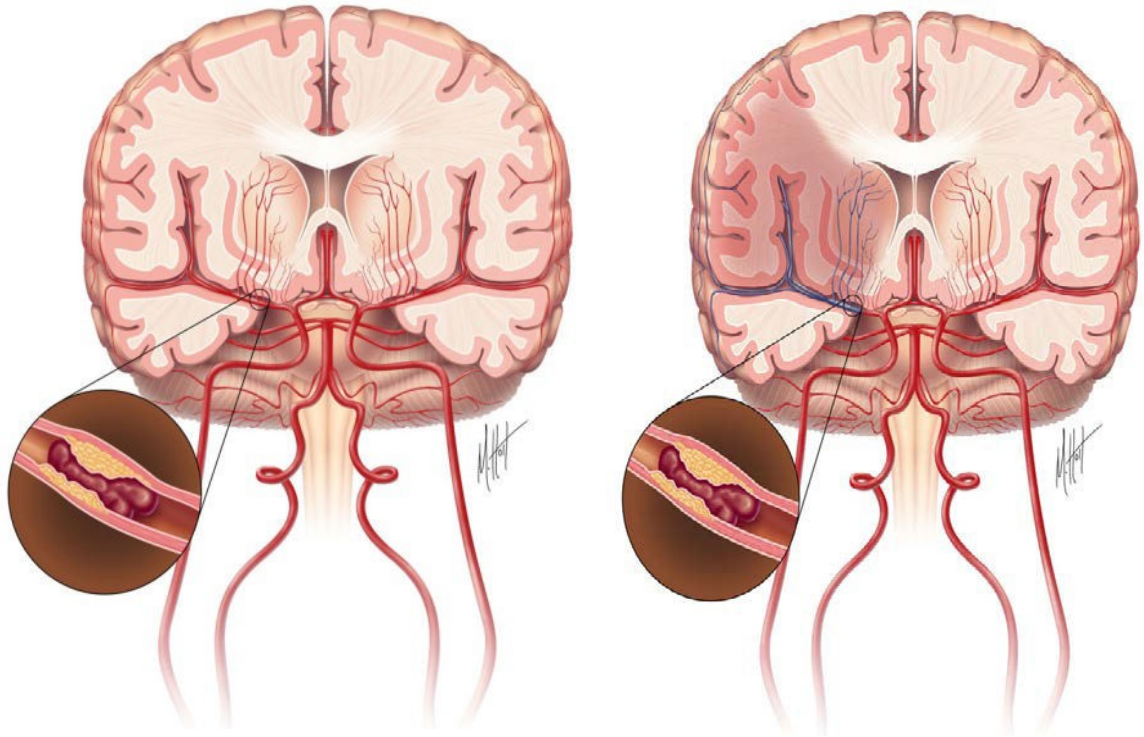

Figure1: Mechanism of brain injury in ischaemic stroke (sourced from: The Internet Stroke Center (www.strokecenter.org/patients/about-stroke/ischemic-stroke/))

Strokes usually present as a sudden onset of neurological deficits which can present as paralysis, weakness or loss of sensation involving the face and/or limbs. They can also present as disturbances in speech or vision and other defects of higher cortical function. The signs and symptoms can be indicative of the area of the brain that has been affected. However, some strokes can be silent, presenting as deterioration in cognitive function, changes in behaviour or disorders of gait and balance with no apparent neurological symptoms (Lindsay et al., 2014).

1.3 Stroke burden and mortality

The past 4 decades have seen a shift in the incidence rates of stroke in both high and LMIC. The age adjusted incidence rates of strokes in high income countries (HIC) (Mellon et al., 2016) have decreased by 42% from 163 per 100 000 person-years in the period 1970-1979, to 94 per 100 000 person-years from 2000-2008 whereas LMIC have seen an increase of more than 100%, from 52 per 100 000 person-years to 117 per 100 000 person-years during the same time periods (Feigin et al., 2009, Mendis,

2013). This increase has been suggested to be a result of factors such as poor access to healthcare, the rising life expectancy and lifestyle changes (Bonita and Beaglehole, 2007, Feigin et al., 2014).

The global burden of disease due to strokes continues to be heavily influenced by the contribution from LMIC. In 2010, globally, strokes were responsible for approximately 5.9 million deaths, 33 million prevalent cases and 102.2 million disability adjusted life years (DALYs) lost, of which 71%, 52% and 78%, respectively, were from LMIC (Feigin et al., 2014). The proportion of patients dying from strokes in the LMIC was disproportionately larger and the patients younger compared to those in HIC (Strong et al., 2007, Sajjad et al., 2013). Having such a large proportion of the economically viable younger population dying as a result of stroke negatively impacts the affected families as well as the LMIC economies.

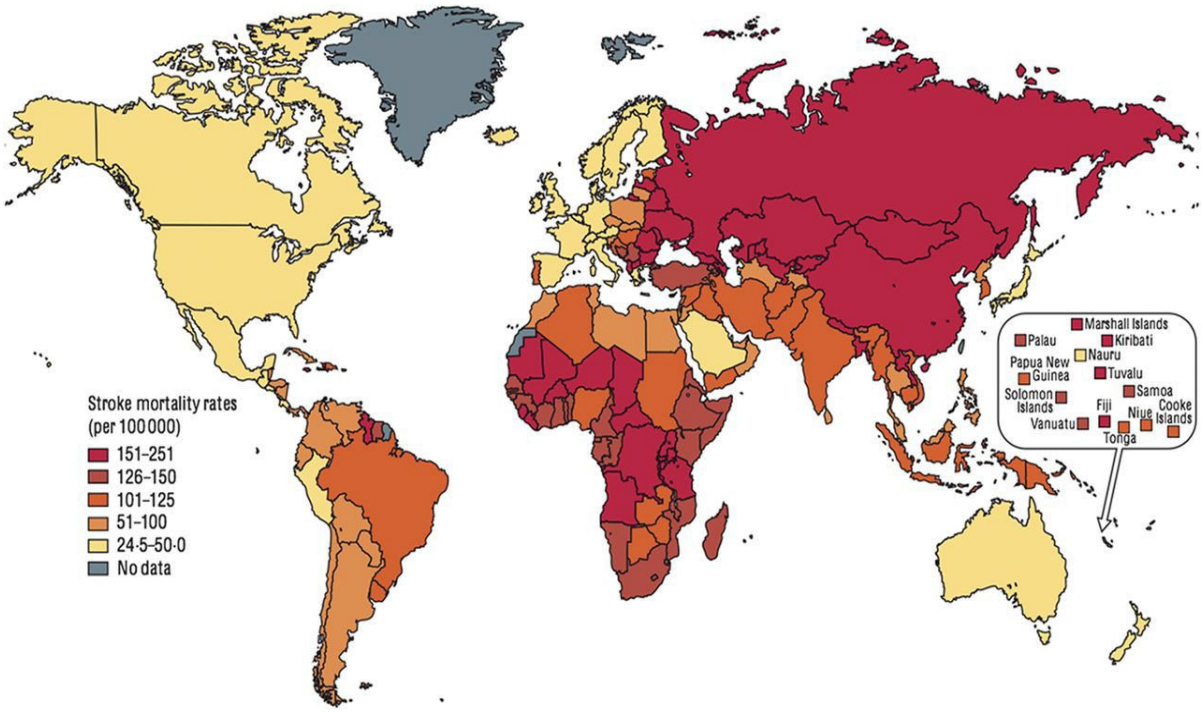

Figure 2: Global stroke mortality rates adjusted for age and gender (Johnston et al., 2009)

Strokes in South Africa, like in many other LMIC, are a major health issue and have resulted in significant death and disability. In 2008, the incidence of stroke in males and females was found to be 465 and 615 per 100000 population, respectively, and the 28

day fatality incidence, 155 and 204 per 100000 population, respectively (Bertram et al., 2013). The burden of disease due to stroke was estimated to be 564000 DALYs, of which 17% was years lived with a disability (Bertram et al., 2013). According to Statistics South Africa, in 2013, cerebrovascular diseases were ranked fourth in the top ten leading causes of death and accounted for approximately 4.9% of deaths (Statistics South Africa., 2013)

Without interventions, the stroke global burden of disease is estimated to continue to rise. The increase in incidence and mortality is expected to rise faster in the LMIC and therefore continue to be higher than in HIC (Strong et al., 2007). It is estimated that by 2030, there will be between 7.8 to 12 million deaths, 23 million incident cases, 70 million prevalent cases and over 200 million DALYs lost annually worldwide (Feigin et al., 2014, Addo et al., 2012). Interventions that combined effective prevention strategies and stroke care have been found to lower incidence and mortality rates attributed to strokes in HIC (Feigin et al., 2014), therefore implementing such interventions could possibly lower the burden of disease due to stroke in LMIC.

2.1 Stroke care

2.2 Acute stroke care

It is recommended that in the acute phase, stroke patients be managed in a stroke unit by a multidisciplinary team (MDT) which "should ideally include a stroke physician, nursing staff, occupational therapist, physiotherapist, speech pathologist, dietician, social worker and where possible a psychologist" (Bryer et al., 2010). However, in many LMIC, there are not enough stroke units (de los Ríos la Rosa and Broderick, 2013) and stroke patients that make it to the hospital are often managed in general medical wards (GMWs). The main aims in the acute phase of stroke care include maintaining homeostasis, early patient mobilisation, preventing complications and at specialised centres (stroke units), when indicated, reperfusion of the ischaemic area of the brain can be attempted (Langhorne et al., 2012).

2.2.1 Reperfusion therapies in acute ischaemic stroke

2.2.1.1 Recombinant tissue plasminogen activator (rt-PA)

Rt-PA is a drug that works by breaking down clots in blood vessels to achieve reperfusion in the ischaemic area of the brain (Wechsler, 2011). Meta-analysis on

stroke patient outcomes found that when rt-PA was administered within 4.5 hours of symptom onset, the patients had better outcomes irrespective of the severity of the stroke or their age (Emberson et al., 2014). The meta-analysis also found that the benefits of rt-PA outweighed the increased risk of developing intracranial haemorrhage during the first few days of therapy. Due to these potential risks, rt-PA should only be provided in stroke centres with access to protocols for drug administration, early brain imaging, laboratory facilities and neurosurgical advice, as well as health providers trained to administer this drug.

2.2.1.2 Emerging therapy: Endovascular clot retrieval (mechanical thrombectomy)

Mechanical thrombectomy the removal of a blood clot using a device inserted into the blood vessel to restore circulation to the affected area of the brain (Kim et al., 2006). It is indicated in patients with a major ischaemic stroke due to proximal vascular occlusion, (Bryer et al., 2010). Like rt-PA, this intervention is time dependant and can only be performed within 6 hours of the onset of stroke symptoms (Smith and Schwamm, 2015). Current guidelines recommend that this form of therapy be performed only by specialists in centres with access to computerized tomography angiograms (Bryer et al., 2010). It is also recommended that ischaemic stroke patients meeting the criteria for rt-PA should first receive it then have mechanical thrombectomy performed (Smith and Schwamm, 2015).

2.1.2 The stroke unit model of care

A stroke unit is a "geographically defined", organized area in the hospital where stroke patients are managed by a dedicated MDT (de Carvalho et al., 2011, Svendsen et al., 2009, de Villiers et al., 2009). The stroke unit model of care is one of the most important and effective aspects of acute stroke care. In addition to a MDT that conducts regular ward rounds; components of a stroke unit include ongoing stroke training programs for all medical professionals involved in stroke management and standardized protocols for acute and post- acute stroke care, all of which ensures the standardization of care (Bryer et al., 2010). Other important components include early mobilisation and rehabilitation of the patients and early involvement of the patient's caregivers.

Involvement of the patient's caregivers in the multidisciplinary meetings, nursing care

and rehabilitation is particularly helpful in resource poor settings where caregivers can be more actively involved in the rehabilitation process and help the patient adhere to secondary prevention recommendations after discharge (Langhorne et al., 2012). In acute stroke units, regular meetings (at least once a week) between the medical staff and the patients and their relatives should be conducted to discuss management, progress and discharge plans (Young and Forster, 2007). The combined effort from the different disciplines as well as the caregivers results in comprehensive and effective care in stroke units affording the patients, the best possible outcome.

There is robust evidence to show that the stroke unit model of care has favourable effects on patient outcomes; reduced odds of dying, being dependent or requiring institutionalized care (Group, 2013, Indredavik et al., 1991, Kalra et al., 2005, Langhorne et al., 1993, Stroke Unit Trialists' Collaboration, 1997, Sun et al., 2013). Many of the randomized controlled trials (RCTs) that demonstrated the effectiveness of stroke units were conducted in HIC. Given the differences in the healthcare systems and economic environments between the high and LMIC, there was debate on how practical and effective stroke units in LMIC would be. Subsequently, studies were conducted examining the effectiveness of stroke units in LMIC and if it was feasible to establish them in resource poor settings.

One of these studies was conducted in Thailand and included patients admitted into a hospital over 2 years (2001-2003) (Suwanwela et al., 2007). In this study, patients managed in stroke units and short term wards were found to have better outcomes and had less overall complications (16%) compared to those managed in the GMWs (26%) ($p<0.001$) (Suwanwela et al., 2007).

Similarly, in a cohort study (retrospective and prospective) conducted in India, it was found that in-hospital mortality and complications were lower in patients managed in stroke units compared to those in the GMWs though there were some differences in participant diagnosis and interventions (Pandian et al., 2011). In this study, there were 201 participants in the intervention arm (stroke units) and 202 in the standard of care arm (general medical wards) with a diagnosis of either ischaemic or haemorrhagic stroke. In the stroke unit and GMWs arms of the study, there were 141 and 128 ischaemic stroke respectively, and 60 and 74 haemorrhagic stroke respectively. The participants in the stroke units were found to have a statistically significant ($p<0.0001$)

reduced mortality (11.9%) compared to the GMWs (47%) and also reduced complications, 42.2% in the stroke unit and 64.8% ($p<0.0001$) in the GMWs (Pandian et al., 2011). In the stroke unit, more participant risk factors were identified and more participants were initiated on secondary prevention drugs on discharge compared to those in the GMWs. Unlike the previous study, they found that participants had longer hospital stays in the stroke unit (mean: 9.4 days +/- 6.7) compared to the GMWs (mean: 7.7 days +/- 8.1) and this was attributed to the hospital's longer rehabilitation programme (Pandian et al., 2011).

The limitation of both the Thai and Indian studies is that they were conducted in urban hospitals and these hospitals are not representative of all the hospitals in these countries. Significant differences in the availability of resources exist among different health institutions within LMIC and this could have an impact on the success of the stroke units.

A 2002 South African study addressed the question about the feasibility of stroke units in resource limited environments. The prospective cohort study conducted in a district hospital in South Africa indicated that a stroke unit could be established at an under-resourced community hospital without incurring additional costs. This study was conducted over a 6- month period; during the first 3 months, data was collected from stroke patients managed in the GMWs (n=94), then over the next 3 months, data collected from those admitted into the newly established stroke unit (n=101). The researchers found that a stroke unit could be established in a low resource setting with little impact on cost and in-patient mortality was reduced from 33% in the general medical ward to 16% in the stroke unit ($p = 0.005$). Though the study was small (n=195), the participants in both arms of the study not matched and the study duration short, the results suggested that positive patient outcomes could potentially be achieved from stroke units in a poor resource setting. (de Villiers et al., 2009).

In summary, the evidence indicates that the acute and post-acute care of stroke patients by a MDT in a stroke unit results has favourable outcomes for patients, in both high and LMIC. There is also evidence to suggest that it is possible to set up stroke units in resource poor settings and achieve patient benefit. Stroke units in LMIC such as South Africa can potentially have a positive impact on patient outcomes and reduce

disability and morbidity rates. Despite the robust evidence on the efficacy of stroke units, many hospitals in the public healthcare sector in South Africa and many other LMIC do not have stroke units (Sposato et al., 2008).

2.2 Post-acute stroke care

The post-acute phase of stroke care mainly involves secondary prevention and rehabilitation. Secondary prevention strategies aim to prevent the recurrence of stroke and this is important because stroke survivors have an increased risk of developing another stroke compared to the general population (Mohan et al., 2011). The aim of rehabilitation is to obtain maximum function in patients through a process that involves maximizing body movement, function and activities, all of which have been shown to increase patient independence (Bernhardt and Cramer., 2013).

2.2.1 Secondary prevention

Secondary prevention strategies that address the identification and management (medical, surgical and behavioural) of risk factors are important in the post-acute phase of stroke care. Stroke risk factors can be classified into modifiable and non-modifiable. Modifiable risk factors such as cigarette smoking, unhealthy diets and diseases like hypertension, can be altered (Mendis., 2013). In contrast, non-modifiable risk factors, such as age, gender and ethnicity cannot be altered. Controlling modifiable risk factors can reduce the risk of stroke recurrence. A recent study found that 17 common modifiable risk factors accounted for 90.5% of the global burden due to stroke (DALYs); 91.1% in the LMIC and 89.3% in HIC (Feigin et al., 2015). There has been a rise in the prevalence of modifiable and non- modifiable risk factors in LMIC and this has been attributed to the rising aging populations, globalization and urbanization (Mendis, 2013).

2.2.1.1 Modifiable risk factors

Hypertension is the most common modifiable risk factor and is responsible for over half of the global stroke deaths (Feigin et al., 2015) and treating hypertension could result in an estimated risk reduction of up to 40% (Sacco et al., 2006, Tibazarwa and Damasceno, 2014). Treating hypertension as well as educating the patients regarding the importance of maintaining and complying with medication could significantly reduce

the risk of stroke.

The administration of HMG-CoA reductase inhibitors (statins) to lower low density lipoproteins and total cholesterol are important in secondary prevention of stroke (Bryer et al., 2010). Studies have found that in secondary prevention, statins reduce the risk of stroke by 18% and mortality due to stroke by 13% (Rothwell et al., 2011). Statins in ischaemic strokes have also been found to have neuroprotective effects which limit damage, improve recovery and prevent early recurrence of stroke (Fisher and Moonis, 2012, Bryer et al., 2010).

Another important risk factor is diabetes mellitus; maintaining glucose control is an important aspect of management and secondary prevention. Maintaining near normal glucose levels can potentially reduce the risk of stroke recurrence (Bryer et al., 2010). Hyperglycaemia is associated with increased morbidity and poor brain recovery (Baker et al., 2011).

The patients' adherence to medication combined with lifestyle changes can reduce the risk of stroke recurrence. The combined lifestyle and behavioural risk factors were responsible for 74.2% of DALYs of the global contribution of modifiable risk factors to the burden of disease due to stroke (Feigin et al., 2015). Lifestyle and behaviour modifications such as smoking cessation, increased physical activity and healthier diets can help to reduce the risk of stroke recurrence.

2.2.1.2 Anti-platelet drugs

Aspirin is an anti-platelet agent recommended for use in secondary prevention of non-cardio- embolic ischaemic strokes (Sandercock et al., 2014). Evidence suggests that when aspirin should be commenced early after an ischaemic stroke has occurred and this results in a reduction in recurrence of ischaemic events (CAST., 1997, Sandercock et al., 2014).

Clopidogrel is another anti-platelet drug that can be used in secondary prevention of ischaemic stroke. There is evidence to indicate that it is marginally more effective than aspirin, however, the effect of secondary prevention with clopidogrel was found to be more marked in diabetic patients with ischaemic stroke (Shulga and Bornstein,

2011). The limitation of clopidogrel is that it is more expensive than aspirin and the maximum platelet activity is delayed by about 4 or 5 days (Shulga and Bornstein, 2011). The added expense of Clopidogrel compared to aspirin could limit its availability in LMIC.

2.2.1.3 Anticoagulants

Vitamin K antagonists such as warfarin have been found to be significantly more effective than aspirin in secondary prevention of cardio-embolic ischaemic stroke, for example, due to atrial fibrillation (Shahpouri et al., 2012). Like warfarin, the newer direct oral anticoagulants (DOAC), have been found to be effective in preventing recurrence of cardio-embolic stroke. They have the added advantage of not requiring regular monitoring and having less drug and food interactions than warfarin (Gomes et al, 2013). However, these DOAC are more expensive and this has limited their use in resource limited settings.

2.3 Rehabilitation

Rehabilitation in stroke patients involves a combination of goal oriented intervention therapies that are aimed at maximizing function (Quinn et al., 2009). This process helps to alleviate the symptoms of the various disabilities that occur as a result of stroke. A variety of specialised health professionals (rehabilitation team) are involved in providing the different forms of therapy required by the stroke patients.

A rehabilitation stroke team is comprised of physiotherapists, occupational therapists, speech and therapists, social workers, psychologists and dieticians as well as nurses and medical doctors with experience in rehabilitation processes (Langhorne and Duncan, 2001). The absence of rehabilitation in the care of stroke patients results in more frequent re- hospitalizations, reduced quality of life and a deterioration in function (Mohd Nordin et al., 2014). The inclusion of a rehabilitation team in the management of stroke in the stroke unit is associated with improved patient recovery and reduced disability and dependency (Langhorne and Duncan, 2001, Mendis, 2013, Mohd Nordin et al., 2014, Bernhardt and Cramer, 2013).

It is recommended that rehabilitation be initiated as soon as possible after the acute stroke patient has been stabilized (Wissel et al., 2013, Quinn et al., 2009). Intensive

task specific rehabilitation intervention strategies in the acute stages of care have been found to be effective in the management of stroke patients as they impact on the level of function on discharge (Teasell and Kalra, 2004, Hanger et al., 2010). A study on elderly stroke patients found that those with a lower level of function on discharge were more likely to require institutional care and were also more likely to die during the follow-up period (Hanger et al., 2010). Therefore, maximizing functional ability through rehabilitation in the acute and post- acute phase has a significant impact on the stroke patients' quality of life and risk of dying.

Rehabilitation should continue after discharge at various facilities that may include outpatient hospital and community based rehabilitation centres, long term care facilities, rehabilitation hospitals and home based care (Wissel et al., 2013, Quinn et al., 2009). The aims of long term rehabilitation are to reintegrate the patient into society; participating in daily activities and functioning as an independent individual. The intensity and frequency of outpatient rehabilitation is usually inadequate and this has an impact on patient recovery (Rhoda et al., 2014, Mohd Nordin et al., 2014). In South Africa and many other LMIC, there is frequently an interruption of services between inpatient care and outpatient or community care and a disruption in the continuation of care after discharge.

The decision as to where the patient will receive optimal rehabilitation following discharge forms part of the discharge planning process involving the patient, family and MDT. The decision will depend not only on patient need but also on the available resources; the demand for beds in rehabilitation hospitals often exceeds supply.

2.3.1 The role of rehabilitation intervention strategies

Physiotherapy is one of the first forms of rehabilitation that an acute stroke patient receives and initially involves positioning, early mobilisation and mobility (Langhorne et al., 2011). The objective of physiotherapy in the post- acute phase is to improve movement, balance and gait (Langhorne et al., 2011, Van Peppen et al., 2004). Meta-analysis found that stroke patients who received physiotherapy had better outcomes and reduced incidence of complications associated with prolonged bed rest such as pressure ulcers and deep vein thrombosis, compared to those who did not receive physiotherapy (Quinn et al., 2009, Van Peppen et al., 2004).

Following a stroke, patients may also develop impairments in swallowing and speech (aphasia and dysarthria), requiring early assessment and intervention by a speech and language therapist (Langhorne et al., 2011). Failure to correctly examine and manage a stroke patient with swallowing difficulties can lead to complications, such as aspiration pneumonia which can contribute significantly to patient outcomes and mortality (Langhorne et al., 2011).

Occupational therapy improves daily living activities by maximising the patient's function in their specific environment (Quinn et al., 2009). Langhorne et al, 2011, suggests that occupational therapy be provided not only for patients with impairments in motor function but also for those with cognitive impairment. A systematic review of community based occupational therapy studies found that stroke patients who received occupational therapy derived positive effects on activities of daily living and these effects were more pronounced in older patients and those where targeted interventions were implemented (Quinn et al., 2009).

Other important forms of rehabilitation include the input by dieticians and psychologists. Feeding can be a problem in stroke patients due to the associated difficulties in swallowing and communication, which can result in malnutrition over time. Malnutrition is common in stroke patients but this can be prevented by the early intervention of dieticians, making it important to properly manage the patient's diet and feeding (Mosselman et al., 2013, Quinn et al., 2009).

Depression is also common in stroke patients and in many cases this goes undiagnosed or inadequately managed (Hackett et al., 2008). This can negatively impact the patients' recovery and quality of life, highlighting the contribution of psychologists in managing depression and other psychological problems that may accompany stroke (Quinn et al., 2009).

3.0 Gaps in stroke care in South Africa

The evidence from studies such as these contributed to the development of the current South African guideline on the management of ischaemic strokes (Bryer et al., 2010). These guidelines outline the acute and post-acute management of ischaemic stroke patients and the proposed minimum requirements for the different level of hospitals in South Africa. However, since this guideline was established, no evaluation has been conducted on the services rendered to ischaemic stroke patients in the country's

hospitals. Such an evaluation is all the more relevant as the quality of acute and post-acute care services are likely to significantly affect patient outcomes after stroke.

Before programs to establish new stroke units in a LMIC can be developed, it is important to first assess the quality of care being provided to the stroke patients, identify any challenges and barriers to optimum care and then incorporate these findings into the intervention plans moving forward.

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PART C: SOUTH AFRICAN MEDICAL JOURNAL MANUSCRIPT

Quality of current ischaemic stroke care practices in the Cape Metro Health District, South Africa

Vimbai Mandizvidza

School of Public Health and Family Medicine, University of Cape Town

Observatory

Cape Town, South Africa

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Abstract

Background: Strokes are an important global cause of disability and death in adults, particularly in low and middle income countries. In South Africa, like in many other low and middle income countries; stroke is an important public health problem.

Objectives: To describe the acute and post-acute ischaemic stroke services offered to ischaemic stroke patients in level 1, 2, and 3 hospitals in the Cape Metro Health District, compare these services to the national guideline and identify any barriers to optimum stroke patient care.

Methods: The study design was descriptive involving semi-structured interviewer administered questionnaires, audit of hospital investigations, and a review of ischaemic stroke patient discharge summaries. The population included six level 1, one level 2 and 2 level 3 public hospitals. Data collected were compared to recommendations in the South African national stroke guideline.

Results: A total of 28 participants from 8 hospitals were recruited for the interviews; 10 doctors and 10 nurses from general medical wards and stroke units and 8 doctors from emergency units. In the two Stroke Units (SUs) (6 beds each), at the level 3 hospitals, the doctors and nurses had access to protocols, diagnostic investigations, recombinant tissue plasminogen activator and had comprehensive multidisciplinary team meetings. Most of the ischaemic stroke patients were admitted in the general medical wards of level 1, 2 and 3 hospitals; however, the level of care in these facilities was not homogenous. Most level 1 and 2 hospitals experienced difficulties transferring patients to higher levels of care and did not have protocols to guide their management, continued medical training programs in stroke care or access to some diagnostic investigations. Some of the challenges that were highlighted include patient delays, inadequate stroke education among health professionals, limited access to diagnostic investigations and shortage of staff and beds.

Conclusion: The two SUs at the level 3 hospitals adhered most closely to the recommended South African national guideline. Variations in the level adherence existed in the general medical wards in level 1, 2 and 3 hospitals. Factors such as a shortage of staff, limited access to diagnostic investigations and patient delay, influenced

the level of adherence to the guideline. Recommendations or further research include implementing interventions to alleviate the challenges highlighted in this study and developing monitoring systems to continue evaluating the quality of acute and post-acute stroke services.

1.0 Introduction

Strokes are an important global cause of disability and death in adults, particularly in low and middle income countries (LMIC) [1-3]. The past 4 decades have seen a shift in the incidence rates of stroke in both high income countries (HIC) and LMIC. The age adjusted incidence rates of strokes in HIC [4] have decreased by 42% between the periods 1970-1979 and 2000-2008 whereas LMIC have seen an increase of more than 100%, from 52 per 100 000 person-years to 117 per 100 000 person-years during the same time periods [5, 6]. In South Africa, like in many other LMIC, stroke is an important public health problem. In 2013, cerebrovascular diseases were ranked fourth in the top 10 leading causes of death in South Africa [7].

Interventions that combine prevention strategies and stroke care have been found to reduce the incidence and mortality rates [8] The management of acute stroke patients in a stroke unit (SU) and by an organised multidisciplinary team (MDT) has been found to impact positively on outcomes [9, 10]. There is robust evidence to show that the stroke unit model of care has favourable effects on patient outcomes; reduced odds of dying, being dependent or requiring institutionalized care [11-16].

Drawing on results from all these studies, the South African guideline for the management of stroke attack was published [17]. However, since the guideline was published in 2010, no evaluation has been conducted to assess the degree to which the guideline is being applied in the hospitals, if at all. The objectives of the study were to describe the acute and post-acute ischaemic stroke services offered to ischaemic stroke patients in level 1, 2, and 3 hospitals in the Cape Metro Health District (CMHD), compare these services to the national guideline and identify any barriers to optimum stroke patient care.

2.0 Methods

This study design was descriptive involving semi-structured interviewer administered questionnaires, audits of hospital management, and a review of ischaemic stroke

patient discharge summaries. The population included all level 1, 2 and 3 public hospitals (n= 6, 1 and 2 respectively) with in-patient facilities in the CMHD and all the hospitals were sampled.

From each of the hospitals, 3 health professionals were randomly selected to participate in the interviews; 1 doctor and 1 nurse each from the general medical wards (GMWs) and 1 doctor from the emergency unit (EU). For the level 3 hospitals, in addition to the 3 health professionals previously mentioned, 1 doctor and 1 nurse from each of the SUs were randomly selected to participate in the interviews. Thus, for each of the level 1 and 2 hospitals, there was a total of 3 health professionals and for each of the level 3 hospitals, a total of 5. The questionnaires had a combination of open-ended, closed-ended and scaled questions (Likert scale). After the interviews, an audit of hospital stroke management was conducted at each hospital.

The review of patient discharge summaries (first admissions) was only conducted at one level 3 hospital, GSH, because it had the most complete discharge records. A total of 145 discharge summaries, for patients 18 years and older, admitted over a 6-month period (1stof August 2016 to 31st of January 2017), were collected. From these, 96 were randomly selected for the analysis. The sample size of 96 ischaemic stroke patients was based on the anticipated prevalence of adherence to guidelines of 50%, 95% confidence interval and a precision of 10%. The variables recorded include age, gender, admitting ward, co-morbidities, laboratory and radiological investigations, whether or not medication for secondary prevention was prescribed and whether they were discharged home or to an institution.

All the data collected was then compared to pre-selected recommendations in the national stroke guideline. These recommendations were selected as they included most of the minimum requirements stipulated for each level of care (level 1, 2 and 3 hospitals) in the guideline. Data from the level 3 hospital, GSH, was triangulated using the interviews, audit and the patient discharge summaries.

3.0 Results

All the data was collected over a 5-month period from February to June 2017. A total of 28 participants from 8 hospitals were recruited for the interviews; 10 doctors and 10 nurses from the GMWs and SUs units and 8 doctors from the EU. One level 1 hospital was not able to participate in the study and no doctors or nurses were recruited from this

facility.

Most of the doctors from the wards (60%) and EU (75%) were medical officers and the rest were medical registrars. For the nurses, most were registered nurses (70%) and the rest were either enrolled nursing assistants or enrolled nurses. The median time since qualifying for the ward doctors, ward nurses and EU doctors were 7 years (Inter-quartile range (IQR): 6.3 to 9), 19 years (IQR: 5.3 to 26) and 5.5 years (IQR: 3.7 to 7.5) respectively and the time since they started managing stroke patients was 2.25 years (IQR: 1.3 to 3), 12 years (IQR: 2 to 15) and 0.84 years (IQR: 0.7 to 2.3) respectively.

Of the 96 patient discharge summaries, 32% were admitted in the SU and of these 48% were female, 55% were hypertensive, 16% were diabetic and 13% had hyperlipidaemia. Those admitted in the SU had a median age and median admission duration of 50.3 years and 16 days, respectively (table 2).

Table 1: Characteristics of sample of ischaemic stroke patients admitted at GSH

	SU (n=31)		GMWs (n=65)	
	Median	%	Median	%
Females		48		52
Age (Years)	50.3 (IQR 38.6 to 62.9)		64.3 (IQR 57.3 to 72.2)	
Duration of admission (days)	16 (IQR 8 to 21)		10 (IQR 6 to 13)	
Hypertension		55		80
Diabetes Mellitus		16		37
Hyperlipidaemia		13		11

Table 2 below illustrates the results in relation to the pre-selected recommendations in the national guideline.

Table 2: Comparison of results to the national guideline [11]

Recommendations [11]	**Study results**
3.1. Ongoing training for health professional involved in stroke care	Of all 28 health professionals; • 16 reported having received some training in stroke care since qualifying and of these, most were as part of broader programs such as courses in acute emergency medicine, internal medicine and neurology training, Advanced Cardiac Life Support (ACLS) and in-service training, refresher courses and workshops. • Only 1 participant reported having completed an examinable stroke course 15 years prior • Of the 12 health professionals who had not received any training, 6 were nurses Out of the 20 doctors and nurses working in the GMWs and SUs; • 8 reported no scheduled seminars on stroke management • Of the 12 who reported having scheduled seminars, 2 reported having tutorials focused on stroke management at least twice a week while the rest had seminars where all medical conditions, including strokes were discussed • The scheduled seminars were in the form of case presentations, consultant ward rounds, academic meetings, journal clubs and nursing seminars.
3.2.1 Protocols for the acute and post-acute management of stroke • Protocols for referral and transfer of selected stroke patients to a level 2 or 3 hospital	• 19 out of the 28 health professionals reported not having any protocols to refer to in the wards and EU • Those who reported having protocols were from 4 hospitals; one level 1, one level 2 and both level 3 hospitals • Of those who reported having protocols available, most strongly agreed that the protocols (commonly located in doctor's offices, resuscitation area, nurse's stations or front desk in the wards), were easily accessible to those who needed to use them • None of the EU doctors in level 1 and 2 hospitals reported having any protocols for upward referral of patients

3.2.2 Evaluation of acute stroke with minimum delay	• 6 out of the 8 EU doctors agreed that strokes were treated as an emergency; however, most reported that this was dependent on whether the stroke patient presented within the window for reperfusion therapy or not. If not, they were not managed as emergencies but would receive urgent treatment
• Use of the National Institutes of Health Stroke Scale (NIHSS) – assessment tool that can be used to grade severity of stroke, predict patient outcomes and determine eligibility for recombinant tissue plasminogen activator (rt-PA)	• 9 out of the 18 doctors agreed that they were familiar with the NIHSS and of those, 8 either disagreed or strongly disagreed that each stroke patient was scored using NIHSS • 3 doctors reported only using it to grade severity in acute stroke patients who qualified for rt-PA
3.2.3 The time interval from diagnosis to transfer to higher level hospitals (level 1 and 2) or from diagnosis to obtaining an interpreted Computerized Tomography (CT) scan	• The EU doctors at level 1 and 2 hospitals reported the time period between making a clinical diagnosis of an acute stroke and them transferring the patient to a level 3 hospital was between 20 minutes and 12 hours • The time interval was dependent on how quickly the ambulance services could despatch a vehicle to the patient. • The level 3 hospital doctors reported that the majority of patients who arrived within the window for rt-PA had an interpreted CT scan within 30 minutes of arrival. • For the patients who arrived at hospitals with CT scan facilities, outside the window for rt-PA, the time interval from diagnosis to obtaining an interpreted CT scan ranged from a few hours up to 2 days.
3.2.4 Swallow test	• Out of the 18 nurses and EU doctors, 72% either agreed or strongly agreed that swallow tests were routinely performed on patients before they were allowed to eat or drink • Speech and language therapists were reported as often being responsible for formally performing swallow tests, followed by doctors and then nurses • Four respondents reported physiotherapists, occupational therapists and dieticians as being responsible for performing swallow tests at their hospitals • Even though doctors and nurses were among those who were responsible for performing swallow tests, 56% reported not having been taught how to do it. Of those who reported having been taught, 50% either agreed or strongly agreed that the method used was standardized.

3.2.5 Availability of recommended diagnostic investigations according to the level of care	
• Laboratory investigations and bedside tests: blood glucose, Full blood count (FBC), urea and electrolytes, creatinine, erythrocyte sedimentation rate (18), C-reactive protein (CRP) and oxygen saturation	• Of the recommended laboratory investigations and bedside tests; a) All the EU doctors reported always conducting urea and electrolytes, FBC and creatinine tests b) 7 out of 8 of these doctors reported that they also conducted random blood glucose and oxygen saturation tests on the stroke patients. One out of the 8 doctors reported conducting random blood glucose tests only when there was an indication; d) None of the EU doctors reported routinely conducting ESR and CRP tests on stroke patients
• Level 1 (district): no additional diagnostic tests stipulated in guideline	• All level 1 hospitals had access to chest x-rays and electrocardiograms (ECGs), however, only ECGs were available after office hours at all centres. Chest x-rays were available after office hours at three out of the five level 1 hospitals • Among the level 1 hospitals, CT scans were available at one hospital, echocardiograms at 2 hospitals and Carotid Doppler sonography at 2 hospitals but none of these investigations were available after office hours.
• Level 2 (regional): CT scan, ECG, chest x-ray, echocardiogram	• During the day, patients attending the level 2 hospital had access to all the investigations recommended by the guideline. However, only chest x-rays and ECGs were available after office hours.
• Level 3 (tertiary): CT scan, Magnetic Resonance Imaging (MRI) scan, Angiography, ECG, chest x-ray, echocardiogram (transthoracic and trans-oesophageal), duplex Doppler carotid sonography	• The level 3 hospitals met all the recommended diagnostic investigations were accessible 24 hours a day

3.2.6 Observations (including frequency) conducted by nurses	• All the nurses reported that they conducted the following observations: body temperature, blood pressure, pulse rate and respiratory rate • For the remaining observations; random blood sugar tests, oxygen saturation, level of consciousness and fluid input and output, most of the nurses reported not routinely conducting these unless indicated by the doctor or there was a specific medical indication • In the SUs, the nurses reported that the frequency of observations ranged from ½-4 hourly and up to 6-8 hourly in the first 24 hours. For those in the GMWs, the frequency of observations ranged from 2-8 hourly • After 72 hours, most of the nurses reported that the frequency of observations depended on the condition of the patient at that time, existing co-morbidities, and the doctor's orders. The frequency could increase, decrease or remain the same.
3.3 The use of rt-PA in acute ischaemic strokes	• rt-PA was only available at the level 3 hospitals • Common reasons stated by the doctors at level 1 and 2 hospitals as to why they did not administer rt-PA was that they has limited access to CT scans and patients presenting outside the window for thrombolysis • Some of the doctors from the level 3 hospitals reported that only a small fraction of acute ischaemic stroke patients received rt-PA, most arrived outside the window for thrombolysis. Of the 96 discharge summaries reviewed at GSH, only 1 patient was recorded as having received rt-PA • Of all the doctors from level 1 and 2 hospitals, 83% reported being able to transfer stroke patients to level 3 hospitals if they were suitable candidates for rt-PA but also reported that this was dependent on the level 3 hospital agreeing to take over management of the patient and also on how quickly the ambulance service could despatch a vehicle • Out of the 18 doctors, 33% set the cut off point for the administration of rt-PA at 4.5 hours, 44% set it at 1 to 4.5 hours, 17% at 3 to 6 hours and 6% at less than 12 hours, after onset of stroke
3.4 The presence a stroke unit	• There were 2 SUs located at the two level 3 hospitals, each with only 6 beds, most of patients were admitted into GMWs • Those at level 1 and 2 hospitals were admitted into GMWs or mixed medical and surgical wards • 26 out of the 28 health professionals were aware of a SU and had some idea of what SU care entailed. •

3.5 The presence of a MDT that conducts combined rounds • a comprehensive MDT at level 2 and 3 hospitals • Level 1 hospital, the minimum staff requirements; doctors, nurses and physiotherapists trained in stroke care	• GMW doctors and nurses at three level 1 hospitals and in both SUs (level 3 hospitals) reported that MDT meetings were held once (level 1) and twice (SUs) a week in their wards. • The GMW doctors and nurses at level 2 and 3 hospitals reported that consultant ward rounds were regularly conducted and health professionals from other disciplines such as physiotherapy or social work were often consulted however no comprehensive MDT meetings were held • There are discrepancies in 3 lower level hospitals where the nurses agreed that MDT meetings were held in the wards and the doctors disagreed. • The MDTs in three of the level 1 hospitals and the 2 SUs included medical doctors, nurses, physiotherapists, social workers and dieticians. Occupational therapists always attended MDT meetings in 4 (two level 1 hospitals and 2 SUs) out of the 5 hospitals. Speech and language therapists were available at 4 (two level 1 hospitals and 2 SUs) out of the 5 hospitals and attended the meetings. Psychologists were not reported to be part of any of the MDTs in the 5 hospitals; however, were consulted if needed. • Unique members of the MDT reported at one level 1 hospital were home based carers who attended each meeting.
3.6 Involvement of patients and relatives	• All the doctors and nurses in the SUs and GMWs at all levels either agreed or strongly agreed that patients and their relatives were involved in management and discharge plans • Issues that were reported to be discussed include stroke definition, risk factors and planned management in hospital and on discharge, medication for secondary prevention, feeding, rehabilitation exercises, patient mobilization, home safety, lifestyle modification and placement after discharge. • Out of the 20 medical doctors and nurses working in the GMWs and SUs, 6 reported specifically addressing psychological problems during discussions with patients and relatives • Out of the 10 nurses, only 2 reported having a standardized list of topics to discuss with patients and their relatives
3.7 Secondary prevention: use of aspirin and drugs for hyperlipidaemia, hypertension and diabetes mellitus	• Hypertension was the most common risk factor among ischaemic stroke patients admitted at GSH (n=96), followed by diabetes mellitus then hyperlipidaemia; 72%, 30% and 12%, respectively • Of those with hypertension and those with diabetes mellitus, 93% and 76%, respectively, received prescriptions for antihypertensive and anti-diabetic drugs, respectively, on discharge • Of those with hyperlipidaemia, 91% received prescriptions for lipid lowering medication on discharge and of those without a diagnosis of hyperlipidaemia, 87% received prescriptions medication • Of the 96 ischaemic stroke patients, 80% had prescriptions for Aspirin on discharge

In the two SUs, the doctors and nurses had access to protocols, diagnostic investigations, rt- PA and had comprehensive MDT meetings. Patients who arrived within the window for thrombolytic therapy frequently had an interpreted CT scan within 30 minutes of arrival. However, the SUs only had 6 beds each, therefore, a large proportion of patients were admitted into GMWs at level 3 hospitals and into GMWs or mixed medical and surgical wards at level 1 and 2 hospitals. Most level 1 and 2 hospitals experienced difficulties transferring patients to higher levels of care and did not have protocols to guide their management, continued medical training programs in stroke care or access to some diagnostic investigations. Of all the health professionals, 32% of the health professionals reported having written stroke management protocols available in the wards and EU and none of the EU doctors reported having protocols for referral and transfer of patients to higher level centres. Even though most did not have set guideline for the discussions they held with patients and their relatives, their involvement in their care and discharge plans was consistently reported across all levels of care.

All the health professionals were asked about the challenges they faced in managing stroke patients at their hospitals and interventions that could be implemented to alleviate these problems. Their responses are shown in table 3 below.

Table 3: Challenges and interventions suggested by the health professionals at the level 1, 2 and 3 hospitals

Challenges	**Proposed interventions**
• Patient delay – most patients presented to the hospital outside the window for reperfusion therapy • Some primary health care providers failed to quickly recognize the signs and symptoms of stroke resulting in either delayed or no referral to higher levels of care • Delays in ambulance services despatching vehicles to transport patients • Delays in the time interval from being triaged to seeing the doctor (EU)	• Community education programs: stroke risk factors, symptoms and the benefits of early interventions • Stroke education for all health professionals at all levels of care • Make protocols more available so that stroke patient care is standardized • Upgrading the ambulance services by either increasing the number of vehicles or having a fast, dedicated stroke ambulance unit that is in constant contact with the stroke doctors at level 3 hospitals • Develop acute stroke protocols for the ambulance service so that all stroke patients within the window for rt-PA are taken directly to level 3 hospitals or at least hospitals with CT scan facilities • Use of the flying squad for acute stroke patients • Better triage training for the nurses in the EU • Adopt a triage system similar to that of one level 1 hospital where an EU doctors sign off on each triaged patient, any acute stroke patients who had not arrived by ambulance were quickly identified • Have the ambulance service inform the stroke doctors about a patient before arrival, so that they bypass the general triage process and see the doctors as soon as they arrive
• Shortage of nurses at all hospital levels: difficult for one nurse to do the 2 hourly turns on overweight patients, not enough time was spent feeding or bathing the patients • Shortage of EU doctors, physiotherapists, speech and language therapists, occupational therapists, dieticians and social workers at level 1 and 2 hospitals.	• Increase the number of health professionals at all hospital levels • Establish more comprehensive rehabilitation departments, for example, in hospital speech and language therapy unit at the level 1 and 2 hospitals • Have the physiotherapists train the nurses how to safely move patients without injuring themselves or the patients • Employ home based carers trained in stroke care to help the nurses with the stroke patients on the wards

• No designated areas in the hospital for stroke patient management	• Establish acute SUs or have designated areas in the hospitals with dedicated staff that conduct regular stroke rounds • SU doctors be more involved in the care of patients in the GMWs at level 3 hospitals
• Shortage of beds in the wards and in the EU; some stroke patients spent more than 24 in the EU before a bed becomes available in the wards • Shortage of beds at the rehabilitation facilities; stroke patients wait long periods for placement	• Increase the number of beds in the SUs • Intensive early intervention could potentially result in better patient outcomes lessening the demand on rehabilitation facility beds
• Shortage of equipment such as pressure mattresses, wheelchairs and bathing equipment • Limited access to diagnostic investigations	• Increase the availability of equipment • Increase access to diagnostic investigations
• Patients who are in denial and become aggressive to nurses • Relatives who cannot cope with the patient at home	• Ongoing counselling patients and relatives • Support for patients and relatives at home through the help of home based carers • Better out-patient care; provision of wheelchairs and having follow up dates that are closer together to monitor risk factor control

Delays were a common challenge faced by the health professionals throughout all levels of care especially delays in patient presentation and transfer. Other challenges included limited access to diagnostic investigations and shortage of staff and beds. Shortage of beds resulted in patients staying longer in hospital, not receiving the rehabilitation services required at that stage in management and occupying beds that could have been used for incoming acute stroke patients.

4.0 Discussion

Generally the two SUs adhered most closely to the recommended South African national guideline [17]. However, only a minority of patients reach care in the SUs and the majority of patients are admitted into GMWs at all levels where there were variations in the degree to which the national guideline was followed. This was consistent with other studies that found that the quality of care offered to stroke patients in LMIC was not homogenous [2].

Apart from the SUs, regular, comprehensive MDT meetings were held at three level 1 hospitals. Among the health professionals only 68% reported having protocols for stroke management, none had protocols for upward referral and 80% of the nurses did not have a standardized list of topics to discuss with patients and relatives. Protocols, regular MDT meetings and having designated areas for stroke patients in the GMWs at all levels could help to standardize and also improve care.

The guideline recommends continued training in stroke care and among the health professionals; nurses seem to have fewer learning opportunities. Inadequate stroke education among health professionals was listed as a challenge in this study, similar to other LMIC studies [19]. Out of the 10 nurses, only four reported having received training in stroke management, of which three worked in level 3 hospitals. Nurses spend the most time with stroke patients compared to other disciplines making it essential to have educational programs specifically for nurses. For the smaller hospitals with fewer doctors, having combined seminars where all medical conditions are discussed is more efficient but stroke management is discussed less often. In these hospitals, it would be beneficial for both the patients and health professionals responsible for care to have more frequent consultant ward rounds where stroke management can be discussed more often.

The patient delay and long ambulance waiting times are challenges that could explain why a

large proportion of acute stroke patients miss the window for rt-PA. Patient delay is a challenge some health professionals in both high and LMIC encounter in managing stroke patients [4, 19, 20]. Other challenges faced were similar to those found in other LMIC; shortage of staff and equipment, lack of protocols, limited access to CT scans and inadequate knowledge among the health professionals [19].

The demand for rehabilitation facilities is higher than what is available which results in patients staying longer in hospitals and blocking beds for new stroke patients. Community rehabilitation centres and home based carers could help with this [21]. There seems to be a disruption of care between hospital care and community based services; home based carers trained in stroke care could help to provide a continuum of care that would make for an easier transition from the hospital to a rehabilitation facility or back to the community. One level 1hospital in the study involved home based carers in the in-patient management of stroke patients who would then follow them up in the community.

Similar to previous studies [22], the analysis of patient discharge summaries (n=96) found hypertension to be a common risk factor (72%) for stroke. Of the three co-morbidities included in the analysis, a large proportion of patients received prescriptions for medication and this is important for secondary prevention. A large proportion of the patients with and without a diagnosis of hyperlipidaemia were prescribed lipid lowering drug which was in line with the national guideline [17].

This study found that the service offered to ischaemic stroke patients especially in the lower level hospitals was inadequate. The inadequacies highlighted in this study can be used as reference point moving forward; how much the health systems need to improve to reach the ideals set in the national guideline.

5.0 Limitations of the study

Patient discharge summaries from one centre (GSH) were reviewed and as these were summaries, some information may have been omitted. It would have been ideal to have reviewed more comprehensive medical records from all the hospitals in the CMHD. Every effort was made to collect data from different health professionals within each hospital but there may nevertheless have been some reporting bias from participants.

Randomly selecting a participant from all the eligible nurses at a particular hospital was difficult because they work in shifts and it would not be possible to conduct interviews at night. Therefore, not all the eligible nurses at a hospital were sampled; participants were randomly selected from the eligible nurses working the day shift on the day of the interview. The data was collected and analysed by one researcher however to improve accuracy and increase transparency, the data analysis records and interview audio files and transcripts were made available to the supervisors.

6.0 Conclusion

The two SUs at the level 3 hospitals adhered most closely to the recommended South African national guideline. Variations in the level adherence existed in the GMWs in level 1, 2 and 3 hospitals. Factors such as a shortage of staff, limited access to diagnostic investigations and patient delay, influenced the level of adherence to the guideline. Interventions should be put in place to alleviate some of these challenges if the quality of stroke care as recommended by the national guideline, is to improve.

The SUs could organise stroke courses for the hospitals in their catchment areas to educate health professionals on stroke care. Having seminars such as these could help create a coordinated and standardized system for stroke care. Guidelines for topics to discuss would ensure that all patients and their relatives have all the information they need. Pamphlets on stroke care printed in different languages can be distributed to educate the patients and relatives.

In addition to describing the quality of current ischaemic stroke care practices in the CMHD, the study also highlighted the challenges that the health professionals faced in managing stroke patients. The study, however, did not examine the background of these challenges, that is, why there were shortages of beds, equipment or staff. Recommendations for further research include an analysis of the health systems in the CMHD to understand why the service delivery for stroke patients in the lower level hospitals is adequate, after which intervention programs can be implemented. Monitoring systems can also be developed to continue evaluating the quality of acute and post-acute stroke services.

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PART D: APPENDICES

Table of Contents

1.1 Participant information form

Title of research project: Quality of current ischaemic stroke practices in the Cape metro health district, South Africa

Introduction

My name is Vimbai Mandizvidza and I am a Masters student at the University of Cape Town School Of Public Health and Family Medicine. I am conducting a study to determine the quality of current ischaemic stroke care practices in a select number of level 1, 2 and 3 hospitals in the Cape Metro Health District. The study has been approved by the Human Subjects Research Ethics Committee in the Health Sciences Faculty at the University of Cape Town.

There is more information about the study below and if you have any questions as you go though the information, please ask and I will explain. After you have read the information, have asked any questions you might have and understood all the information provided, you will be invited to take part in the study. If you agree to take part in the study, you will then be asked to sign a consent form.

1. **What is the purpose of the study?**

   The purpose of the study is to determine the quality of current ischaemic stroke care practices in level 1, 2 and 3 hospitals in the Cape Metro Health District. Data collected from this study will be used to develop interventions that will bridge the gap between current stroke care practices and the South African stroke guideline recommendations. These interventions can possibly result in better stroke patient management and outcomes.

2. Why have I been chosen to participate in this study?

Doctors and nurses involved in the management of stroke patients in the emergency unit and in the ward have been randomly selected to participate in this study. The criterion for inclusion is that the doctor or nurse needs to have worked in their respective departments for at least 6 months in this hospital. You have been selected because you meet this criterion for inclusion in the study.

3. What will happen if I agree to participate in the study?

I will ask you a number of questions in an interview. The questions will involve your work in the management of stroke patients at this hospital. The interview will be recorded to ensure accurate collection of information and I will also take some notes. I will interview you in a private room at a time that is convenient for you. The interview will last about 30 to 45 minutes.

4. Do I have to participate in the study?

No. Please note that it is your decision whether or not to participate in the study. If you decide not to participate in the study, you will not incur any penalties. If you decide to participate in the study, you are still free to withdraw at any time and you will not be required to give any reasons for your decision.

5. Confidentiality

The consent form and all the information collected during the interview will be kept strictly confidential. When the report is drawn up, I will make every effort to ensure anonymity of the responses so that the person who made comments or suggestions cannot be identified from the report. In the report, your responses will be anonymized;

therefore, it would not be possible for your responses to be matched to a particular health facility.

6. Risks

All the questionnaires, recordings and consent forms will be stored in a locked cupboard at the University Of Cape Town School Of Public Health and Family Medicine and any data stored in computer files will be password protected.

7. How will participating in the study benefit me?

There will be no direct benefit to you. The possible benefit is to generate information to improve the management of ischaemic strokes. After all the interviews for your health facility have been completed, you will be provided with information on the current South African ischaemic stroke guidelines. There will be no financial compensation.

8. What will happen to the information you collect during the interview?

The information collected during this study and the results obtained will be published in the form of a Masters dissertation. This dissertation will be available at the University of Cape Town medical school library and it can also be accessed online. The results of this study may also be published in a scientific journal. In all the publications, your identity will be protected and I will not use any names or mention any factors that might identify you in the report.

9. If I need more information, whom do I contact?

If you have any other questions that have not been answered above or you need further clarification on certain points, you can contact;

i. Dr. Vimbai Mandizvidza, University of Cape Town School of Public Health. +27606916171. drvimbai@gmail.com.
ii. Principal Investigator: Professor Leslie London, University of Cape Town

School of Public Health. Tel (021) 406 6524

iii. Ms Shuretta Thomas, Health Sciences Human Research Ethics Committee, Room 24, E52, Old Main Building, Groote Schuur Hospital. Tel: (021) 406 6338

2. Consent form

Title of research project: Quality of current ischaemic stroke practices in the Cape metro health district, South Africa

1. I have read the information form and have been given the opportunity to ask questions. Any questions I had were answered.
2. I understand that my participation in this study is voluntary and that I can withdraw from the study at any time.
3. I understand that my comments may be included in the final report but will be done in a way that I cannot be personally identified.
4. I understand that this research will be published in the form of a Masters dissertation and may also be published in research journal.
5. I agree to participate in this study.
6. I agree to have notes taken during the interview.
7. I agree to have the interview recorded.

Printed name (participant): …….

Signature (participant): ……..

Printed name (witness): …….

Signature (witness): ……

Date: …….....

Signature of researcher: …….

Hospital: …….

3.0 Questionnaires

3.1 Nurse in the ward

1. What is your rank as a nurse in this hospital?

   Enrolled nursing assistant ☐

   Enrolled nurse ☐

   Registered nurse ☐

   Other, specify; ☐

2. i. How long have you been working as a nurse?

   ☐ Years ☐ Months

   ii. And how long have you been managing stroke patients as a nurse on the ward at this hospital? *[To be excluded if less than 6 months]*

   ☐ Years ☐ Months

3. i. Besides your nursing training, have you received any special training in the management of stroke patients?

   Yes ☐ No ☐

ii. If yes, how long ago did you last receive the training in management of stroke patients?

☐ Years ☐ Months

iii. Describe the last training you received in stroke patient management?

4. i. Do you have seminars or tutorials that focus on the management of stroke patients organised by the health professionals working at this hospital?

Yes ☐ No ☐

ii. If yes, how often are these seminars or tutorials held?

5. i. Does your ward have written protocols on the management of stroke patients?

Yes ☐ No ☐

ii. If yes, where are these protocols placed?

iii. Are these protocols accessible to all health professionals who want to use them? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

6. i. Are you familiar with the term stroke unit?

Yes ☐ No ☐

ii. If yes, what is a stroke unit?

iii. Do you have a designated area in the hospital where hospital beds are reserved specifically for the management of stroke patients?

Yes ☐ No ☐

iv. If no, in which ward/s are stroke patients admitted in this hospital*? [Note if respondent gives more than one response]*

General medical ward ☐

Intensive care unit ☐

Other, specify ☐

7. i. When a patient is admitted onto the ward with a diagnosis of stroke, how often do you usually conduct observations on them in the first 24 hours?

☐

ii. Which of the following observations do you conduct on the stroke patients*? [Tick all that apply]*

Routine:	Body temperature	☐
	Blood pressure	☐
	Level of consciousness	☐
	Pulse rate	☐
	Respiratory rate	☐
	Oxygen saturation	☐
Other:	Blood sugar	☐
	Fluid input and output	☐

iii. Does the frequency of observations change after patients have been admitted in the ward for more than 72 hours? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

iv. If you agree, it what way do the observations change?

8. i. Is a swallow test routinely done on acute stroke patients before they are allowed to eat or drink? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

ii. If you agree, who does the test?

iii. If you have to do it, have you been taught how to do a swallow test?

Yes ☐ No ☐

iv. Is everyone who needs to know how to conduct a swallow test, taught to perform it in exactly the same way? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

v. Describe how a swallow test is done at your hospital?

9. i. Are meetings held by the health professionals responsible for stroke patient care to discuss the management and progress of patients?

Yes ☐ No ☐

ii. If yes, how often are these meetings held?

iii. Who attends these meetings?

Medical doctors ☐

Nurses ☐

Physiotherapists ☐

Speech and language therapists ☐

Occupational therapists ☐

Dieticians ☐

Psychologists ☐

Social workers ☐

other; ☐

iv. Does the doctor in charge of stroke patient care attend each meeting? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

10. i. Are the patients and their relatives currently involved in the patient's discharge plans? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

ii. If you agree, how are they involved?

☐

iii. What issues are discussed during these meetings? *[Tick all that apply]*

Patient and relative education:

Medication for secondary prevention ☐

Lifestyle modification ☐

Rehabilitation exercises ☐

Home safety ☐

Mobilization of the patient ☐

Psychological problems ☐

Other, specify ☐

iv. Do you have standardised guidelines with a list of topics that are discussed with the patients and their relatives?

Yes ☐ No ☐

11. What difficulties have you encountered in managing stroke patients in your hospital?

12. In your opinion, what interventions can be put in place to improve the care of stroke patients in this hospital?

3.2 Doctor in the ward

1. Are you a

   Medical officer ☐

   Medical registrar ☐

   Other, specify ☐

2. i. How long have you been working as a medical doctor?

   ☐ Years ☐ Months

   ii. How long have you been managing stroke patients in this hospital? *[To be excluded if less than 6 months]*

   ☐ Years ☐ Months

3. i. Have you receive any special training on the management of stroke patients since qualifying?

   Yes ☐ No ☐

   ii. If yes, how long ago did you receive this training?

   ☐ Years ☐ Months

iii. Describe the kind of training you received?

4. i. Do you have any scheduled seminars or tutorials on the management of stroke patients for all health professionals involved in stroke care at this hospital?

Yes ☐ No ☐

ii. If yes, how often are these seminars or tutorials held?

iii. Who conducts these seminars or tutorials?

iv. How is a decision made on which topics to cover?

5. i. Does your ward have written protocols for the management of stroke patients?

Yes ☐ No ☐

ii. If yes, where are they placed?

iii. Are these protocols currently accessible to all health professionals who want to use them? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

6. i. Are you familiar with the term stroke unit?

Yes ☐ No ☐

ii. If yes, what is a stroke unit?

iii. Do you have a designated area in the hospital where hospital beds are reserved specifically for the management stroke patients?

Yes ☐ No ☐

iv. If no, in which ward or wards are stroke patients admitted in this hospital? *[Note if respondent gives more than one response]*

General medical ward ☐

Intensive care unit ☐

Other, specify ☐

7. i. Are you familiar with the National Institutes of Health Stroke Scale (NIHSS)?

Yes ☐ No ☐

ii. Do you currently score each stroke patient admitted using NIHSS? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

8. i. Up to how many hours after the onset of an acute ischaemic stroke can a patient receive intravenous thrombolytics?

☐ Hours

ii. Can an acute ischaemic stroke patient receive intravenous thrombolytics at this hospital?

Yes ☐ No ☐

iii. If no, why?

☐

iv. Are you able to transfer patients to tertiary hospitals if they are suitable candidates for thrombolysis?

Yes ☐ No ☐

9. i. Do you have the following diagnostic tests at this hospital?

CT scan	yes	☐	no	☐
MRI scan	yes	☐	no	☐
Chest x-ray	yes	☐	no	☐
Electrocardiogram	yes	☐	no	☐
Echocardiogram	yes	☐	no	☐
Carotid Doppler	yes	☐	no	☐

ii. Among the diagnostic tests that you have available, which are available 24 hours a day?

CT scan MRI ☐

scan Chest x- ☐

ray ☐

Electrocardiogram ☐

Echocardiogram Carotid ☐

Doppler ☐

iii. Do you have health professionals available to interpret the CT scans?

Yes ☐ No ☐

iv. If yes, are they available to interpret the scans after working hours?

Yes ☐ No ☐

10. i. Are meetings held by the health professionals responsible for stroke patient care to discuss the management and progress of patients?

Yes ☐ No ☐

ii. If yes, how often are they held?

☐

iii. Do the ward doctors attend these meetings? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

iv. Who else attends these meetings?

Nurses ☐

Physiotherapists ☐

Speech and language therapists ☐

Occupational therapists ☐

Dieticians ☐

Psychologists ☐

Social workers ☐

Other, specify ☐

11. i. Are the patients and their relatives currently involved in the patients' discharge plans? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

ii. If you agree, how are they involved?

iii. What issues are discussed during these meetings? *[Tick all that apply]*

Patient and relative education:

Medication for secondary prevention ☐

Lifestyle modification ☐

Rehabilitation exercises ☐

Home safety ☐

Mobilization ☐

Psychological problems ☐

Other, specify

12. What are the difficulties you have encountered in the management of stroke patients in your hospital?

13. In your opinion, what interventions can be put in place to improve the care of stroke patients in this hospital?

3.3 Emergency unit doctor

1. Are you a

   Medical officer ☐

   Medical registrar ☐

   Other, specify ☐

2. i. How long have you been working as a medical doctor?

   ☐ Years ☐ Months

   ii. How long have you been working in the emergency unit at this hospital? *[To be excluded if less than 6 months]*

   ☐ Years ☐ Months

3. i. Since qualifying, have you received any training in the management of patients with acute stroke in the emergency unit?

   Yes ☐ No ☐

   ii. If yes, how long ago did you receive this training?

   ☐ Years ☐ Months

iii. Describe the kind of training you received.

4. Are strokes currently treated as an emergency in the emergency unit of this hospital? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

5. i. Does the emergency unit have written protocols on the management of stroke patients?

Yes ☐ No ☐

ii. If yes, where are they placed?

iii. Are these protocols currently accessible to all health professionals who want to use them? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

6. i. Are you familiar with the term stroke unit?

Yes ☐ No ☐

ii. If yes, what is a stroke unit?

iii. Do you have a designated area in the hospital where hospital beds are reserved specifically for the management of stroke patients?

Yes ☐ No ☐

iv. If no, in which ward/s are stroke patients admitted in this hospital? *[Note if respondent gives more than one response]*

General medical ward ☐

Intensive care unit ☐

Other, specify

7. i. Are you familiar with the National Institutes of Health Stroke Scale (NIHSS)?

Yes ☐ No ☐

ii. Do you currently score each stroke patient treated in the emergency unit using NIHSS? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

8. Are the following investigations conducted on a patient with a suspected stroke?

Blood glucose (rapid test using dextrostix)	yes	☐	no	☐
Full blood count	yes	☐	no	☐
Urea, creatinine and electrolytes	yes	☐	no	☐
Erythrocyte sedimentation rate (ESR)	yes	☐	no	☐
C- reactive protein (CRP)	yes	☐	no	☐
Oxygen saturation	yes	☐	no	☐

9. i. In your hospital, is a swallow test routinely performed on acute stroke patients before they are allowed to eat or drink? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

ii. Who does the swallow test in the emergency unit of this hospital?

iii. If you have to do it, have you been taught how to do the swallow test?

Yes ☐ No ☐

iv. How is a swallow test performed at this hospital?

v. Is the method used to perform a swallow test at this hospital standardized? *[Please indicate your degree of agreement or disagreement with the statement using the scale below in your response]*

1 Strongly disagree 2 Disagree 3 Undecided 4 Agree 5 Strongly agree

10. i. Up to how many hours after the onset of an acute ischaemic stroke can a patient receive intravenous thrombolytics?

☐ Hours

ii. Can an acute ischaemic stroke patient receive intravenous thrombolytics at this hospital?

Yes ☐ No ☐

iii. If no, why?

☐

iv. Are you able to transfer patients to tertiary hospitals if they are suitable candidates for thrombolysis?

Yes ☐ No ☐

11. i. Do you have the following diagnostic tests at this hospital?

CT scan	yes	☐	no	☐
MRI scan	yes	☐	no	☐
Chest x-ray	yes	☐	no	☐
Electrocardiogram	yes	☐	no	☐
Echocardiogram	yes	☐	no	☐
Carotid Doppler	Yes	☐	no	☐

ii. Among the diagnostic tests that you have available, which are available 24 hours a day?

CT scan	☐
MRI scan	☐
Chest x-	☐
ray	☐
Electrocardiogram	
Echocardiogram	☐
Carotid Doppler	☐

iii. Do you have health professionals available to interpret the CT scans?

Yes ☐ No ☐

iv. If yes, are they available to interpret the scans after working

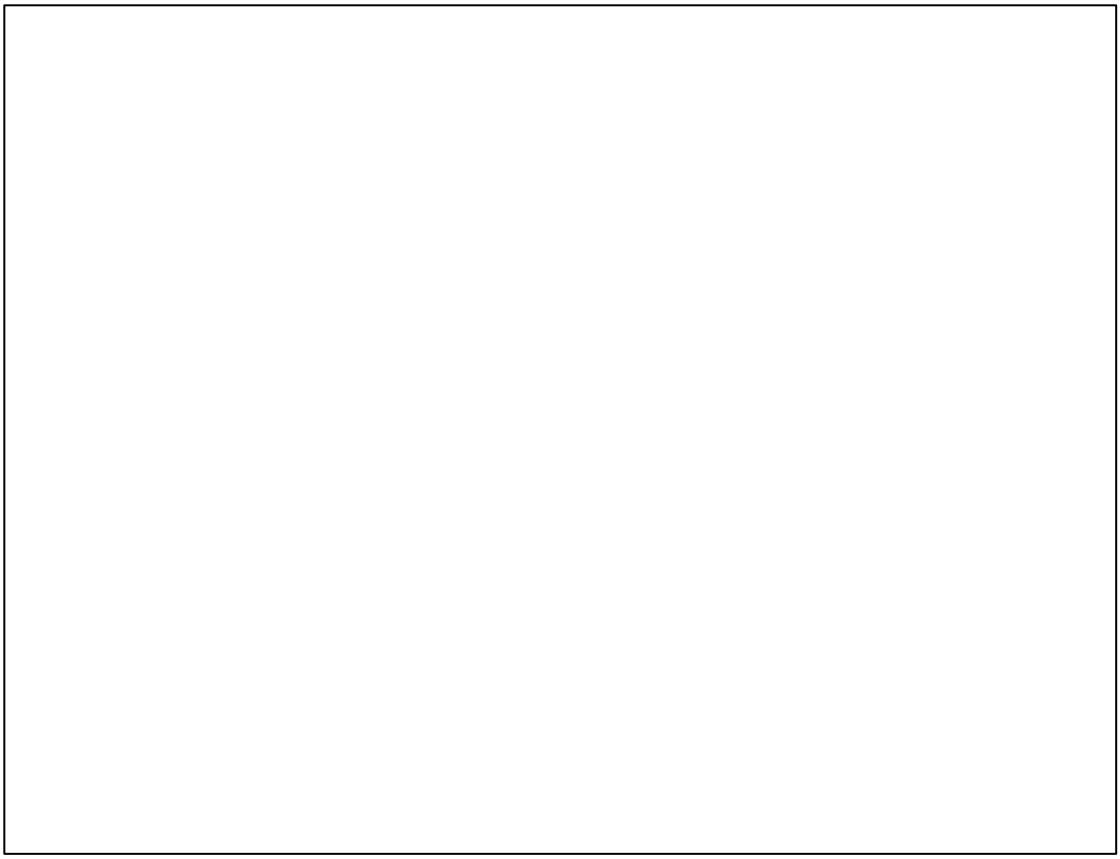
hours? Yes ☐ No ☐

12. What is the average estimated time period (minutes or hours), in your opinion, between the arrival of the suspected acute stroke patient in the emergency unit and obtaining an interpreted CT or MRI scan?

☐ Hours ☐ Minutes

13. Describe the difficulties you have encountered in the management of stroke patients in this hospital.

14. In your opinion, what interventions can be put in place to improve the care of stroke patients in this hospital?



4.0 Audit of stroke care services as per South African guidelines for the management of ischaemic stroke and transient ischaemic attack 2010

4.1 Level 1 hospitals (district)

Name of hospital ……..

1. Minimum staff requirements (trained in stroke care);
    1.1. Medical doctor
    1.2. Nurse
    1.3. Physiotherapist
2. Protocols
    2.1. Acute and post-acute management of stroke – with attention to active management of physiological abnormalities and to maintain homeostasis
    2.2. Referral and transfer of select patient to level 2 or 3 hospital
3. Education of the patient and their relatives - standardised guidelines with a list of topics that are discussed with the patients and their relatives

4.2 Level 2 hospitals (regional)

Name of hospital ……..

1. Designated area in the hospital with designated stroke unit beds
2. A multidisciplinary team which includes;
    2.1. Medical doctors including a stroke physician and an internal medicine specialist cover trained in stroke care
    2.2. Nurse
    2.3. Physiotherapist
    2.4. Occupational therapist
    2.5. Speech and language therapist
    2.6. Social worker
    2.7. Dietician
    2.8. Psychologist

3. Education of the patient and their relatives - standardised guidelines with a list of topics that are discussed with the patients and their relatives

4. Protocols for;

    4.1. Acute and post-acute management of stroke – with attention to active management of physiological abnormalities and to maintain homeostasis

    4.2. Intravenous thrombolysis for acute ischaemic stroke

    4.3. Transfer of select stroke patients to level 3 hospitals

5. Investigations available (radiological and laboratory);

    5.1. Computerized tomography scan (CT scan)

    5.2. Electrocardiogram (ECG)

    5.3. Chest x-ray (CXR)

    5.4. Full blood count (FBC)

    5.5. Erythrocyte sedimentation rate (ESR)

    5.6. International normalized ratio (INR)

    5.7. Syphilis testing (VDRL and RPR)

    5.8. Blood sugar

    5.9. Urea and electrolytes

6. Access to an echocardiogram

4.3 Level 3 hospitals (tertiary)

Name of hospital ……..

1. Designated area in the hospital with designated stroke unit beds

2. A multidisciplinary team which includes;

2.1. Medical doctors including stroke specialists (specialist physicians or neurologists trained in stroke care and/ or neurosurgical service)

2.2. Nurses

2.3. Physiotherapists

2.4. Occupational therapists

2.5. Speech and language therapists

2.6. Social workers

2.7. Dieticians

2.8. Psychologists

3. Education of the patient and their relatives - standardised guidelines with a list of topics that are discussed with the patients and their relatives

4. Protocols for;

4.1. Acute and post-acute management of stroke – with attention to active management of physiological abnormalities and to maintain homeostasis

4.2. Intravenous and intra-arterial interventional (thrombolysis) management of acute ischaemic stroke

4.3. Investigation and management of stroke in young patient

5. Investigations available (radiological and laboratory);

5.1. Computerized tomography scan (CT scan)

5.2. Magnetic resonance imaging (MRI)

5.3. Angiography

5.4. Duplex Doppler carotid sonography

5.5. Echocardiograms (including transthoracic and trans-oesophageal echocardiogram)

5.6. Electrocardiogram (ECG)

5.7. Chest x-ray (CXR)

5.8. Full blood count (FBC)

5.9. Erythrocyte sedimentation rate (ESR)

5.10. International normalized ratio (INR)

5.11. Syphilis testing (VDRL and RPR)

5.12. Blood sugar

5.13. Urea and electrolytes

5.0 Patient discharge summaries

Patient ID 0000

Date of birth DD/MMM/YYYY Age *years*

Gender: Male □ Female□

Duration of admission…….

Admitting ward: Acute Stroke Unit □

Medical Ward □

Co-morbidities: Hypertension □

Diabetes Mellitus □

Hyperlipidaemia □

Other……

Lab Investigations: FBC □ U+E □ Creatinine □
RBS □ ESR □ CRP □

Other investigations: ECG □ CXR □

CT scan: Yes □ No □

Rt-PA used: Yes □ No □

Medication for secondary prevention:

Aspirin □

Medication for Hypertension □

……..……..

……..……..

Medication for Diabetes Mellitus □

……

……..……..

Medication for Hyperlipidaemia □

……..……..

……..……...

Other…….

……

Discharge: Home □

Institution □

……..

5.1. Description of variables and coding for the patient discharge summaries

Variable name	***Description***	***Coding***
Age	Numerical variable measured in years	
Gender	Categorical variable	Male = 1 Female = 0
Duration of admission	Numerical variable measured in days	
Admitting ward	Categorical variable. The ward in which the ischaemic stroke patient was admitted.	Acute stroke unit = 1 General medical ward = 0
Co-morbidities	Categorical variable. Whether the patient was hypertensive, diabetic or had hyperlipidaemia	Hypertension: Yes =1, No = 0 Diabetes mellitus: Yes =1, No = 0 Hyperlipidaemia: Yes =1, No = 0
Lab investigations	Categorical variable. Mandatory laboratory investigations that should be performed on every ischaemic stroke patient	FBC: Yes =1, No = 0 U + E: Yes =1, No = 0 Creatinine: Yes =1, No = 0 RBS: Yes =1, No = 0 ESR: Yes =1, No = 0 CRP: Yes =1, No = 0
Other investigations	Categorical variable. Other mandatory investigations that should be performed on every ischaemic stroke patient	ECG Yes =1, No = 0 CXR Yes =1, No = 0
The use of rt-PA	Categorical variable. Whether rt-PA was given to an ischaemic stroke patient or not	Yes = 1 No = 0
Medication for secondary prevention	Categorical variable. Medications that were given to the patient for secondary prevention of ischaemic stroke.	Aspirin Yes =1, No = 0 Anti-hypertensive drugs Yes =1, No = 0 Drugs for Diabetes Mellitus: Yes =1, No = 0 Drugs for hyperlipidaemia: Yes =1, No = 0
Discharge	Categorical variable. Where the patient was discharged to after acute and post-acute ischaemic stroke care was given to the patient.	Home = 1 Institution = 0

6.0 Letter of approval from UCT Human Research Ethics Committee

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E53-46 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6626
Email: shurette.thomas@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

15 November 2016

HREC REF: 721/2016

Prof L London
Public Health & Family Medicine
Falmouth Building

Dear Prof London

PROJECT TITLE: QUALITY OF CURRENT ISCHAEMIC STROKE CARE PRACTICES IN THE CAPE METRO HEALTH DISTRICT, SOUTH AFRICA (MASTERS CANDIDATE - DR V MANDIZVIDZA)

Thank you for your response to the Faculty of Health Sciences Human Research Ethics Committee dated 8th November 2016.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30th November 2017.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period. (Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval before the research may occur.

The HREC acknowledge that the student, Dr Vimbai Mandizvidza will also be involved in this study.

Yours sincerely

signature removed

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

HREC 721/2016

7.0 Instructions for authors: South African Medical Journal

Manuscript preparation

General article format/layout

Accepted manuscripts that are not in the correct format specified in these guidelines will be returned to the author(s) for correction, which will delay publication.

General:

- Manuscripts must be written in UK English.
- The manuscript must be in Microsoft Word format. Text must be single-spaced, in 12-point Times New Roman font, and contain no unnecessary formatting (such as text in boxes).
- Please make your article concise, even if it is below the word limit.
- Qualifications, ***full*** affiliation (department, school/faculty, institution, city, country) and contact details of ALL authors must be provided in the manuscript and in the online submission process.
- Abbreviations should be spelt out when first used and thereafter used consistently, e.g. 'intravenous (IV)' or 'Department of Health (DoH)'.
- Include sections on Acknowledgements, Conflict of Interest, Author Contributions and Funding sources. If none is applicable, please state ‘none’.
- Scientific measurements must be expressed in SI units except: blood pressure (mmHg) and haemoglobin (g/dL).
- Litres is denoted with an uppercase L e.g. 'mL' for millilitres).
- Units should be preceded by a space (except for % and ºC), e.g. '40 kg' and '20 cm' but '50%' and '19ºC'.
- Please be sure to insert proper symbols e.g. µ not u for micro, a not a for alpha, b not B for beta, etc.
- Numbers should be written as grouped per thousand-units, i.e. 4 000, 22 160.
- Quotes should be placed in single quotation marks: i.e. The respondent stated: '...'
- Round brackets (parentheses) should be used, as opposed to square brackets, which are reserved for denoting concentrations or insertions in direct quotes.
- If you wish material to be in a box, simply indicate this in the text. You may use the table format –this is the *only* exception. Please DO NOT use fill, format lines and so on.

SAMJ is a generalist medical journal, therefore for articles covering genetics, it is the responsibility of authors to apply the following:

- Please ensure that all genes are in italics, and proteins/enzymes/hormones are not.
- Ensure that all genes are presented in the correct case e.g. TP53 not Tp53.

**NB: Copyeditors cannot be expected to pick up and correct errors wrt the above, although they will raise queries where concerned.

- Define all genes, proteins and related shorthand terms at first mention, e.g. ‘188del11’ can be glossed as ‘an 11 bp deletion at nucleotide 188.’
- Use the latest approved gene or protein symbol as appropriate:

- Human Gene Mapping Workshop (HGMW): genetic notations and symbols
- HUGO Gene Nomenclature Committee: approved gene symbols and nomenclature
- OMIM: Online Mendelian Inheritance in Man (Gdalevich et al.) nomenclature and instructions
- Bennet et al. Standardized human pedigree nomenclature: Update and assessment of the recommendations of the National Society of Genetic Counselors. J Genet Counsel 2008;17:424-433: standard human pedigree nomenclature.

Preparation notes by article type

- Research
-
- CME
- In Practice and Case reports
- Reviews
- Clinical trials
- Correspondence
- Obituaries
- Book reviews

Guidelines

Research

Guideline word limit: 4 000 words

Research articles describe the background, methods, results and conclusions of an original research study. The article should contain the following sections: introduction, methods, results, discussion and conclusion, and should include a structured abstract (see below). The introduction should be concise – no more than three paragraphs – on the background to the research question, and must include references to other relevant published studies that clearly lay out the rationale for conducting the study. Some common reasons for conducting a study are: to fill a gap in the literature, a logical extension of previous work, or to answer an important clinical question. If other papers related to the same study have been published previously, please make sure to refer to them specifically. Describe the study methods in as much detail as possible so that others would be able to replicate the study should they need to. Results should describe the study sample as well as the findings from the study itself, but all interpretation of findings must be kept in the discussion section, which should consider primary outcomes first before any secondary or tertiary findings or post-hoc analyses. The conclusion should briefly summarise the main message of the paper and provide recommendations for further study.

Select figures and tables for your paper carefully and sparingly. Use only those figures that provided added value to the paper, over and above what is written in the text.

Do not replicate data in tables and in text .

Structured abstract

- This should be 250-400 words, with the following recommended headings:

o **Background:** why the study is being done and how it relates to other published work. o **Objectives:** what the study intends to find out

o **Methods:** must include study design, number of participants, description of the intervention, primary and secondary outcomes, any specific analyses that were done on the data.

o **Results:** first sentence must be brief population and sample description; outline the results according to the methods described. Primary outcomes must be described first, even if they are not the most significant findings of the study.

o **Conclusion:** must be supported by the data, include recommendations for further study/actions.

- Please ensure that the structured abstract is complete, accurate and clear and has been approved by all authors.
- Do not include any references in the abstracts.

Here is an example of a good abstract.

Main article

All articles are to include the following main sections: Introduction/Background, Methods, Results, Discussion, Conclusions.

The following are additional heading or section options that may appear within these:

- Objectives (within Introduction/Background): a clear statement of the main aim of the study and the major hypothesis tested or research question posed
- Design (within Methods): including factors such as prospective, randomisation, blinding, placebo control, case control, crossover, criterion standards for diagnostic tests, etc.
- Setting (within Methods): level of care, e.g. primary, secondary, number of participating centres.
- Participants (instead of patients or subjects; within Methods): numbers entering and completing the study, sex, age and any other biological, behavioural, social or cultural factors (e.g. smoking status, socioeconomic group, educational attainment, co-existing disease indicators, etc)that may have an impact on the study results. Clearly define how participants were enrolled, and describe selection and exclusion criteria.
- Interventions (within Methods): what, how, when and for how long. Typically for randomised controlled trials, crossover trials, and before and after studies.
- Main outcome measures (within Methods): those as planned in the protocol, and those ultimately measured. Explain differences, if any.

Results

- Start with description of the population and sample. Include key characteristics of comparison groups.
- Main results with (for quantitative studies) 95% confidence intervals and, where appropriate, the exact level of statistical significance and the number need to treat/harm. Whenever possible, state absolute rather than relative risks.
- Do not replicate data in tables and in text.
- If presenting mean and standard deviations, specify this clearly. Our house style is to present this as follows:
- E.g.: The mean (Mosselman et al.) birth weight was 2 500 (1 210) g. Do not use the ± symbol for mean (Mosselman et al.).
- Leave interpretation to the Discussion section. The Results section should just report the findings as per the Methods section.

Discussion

Please ensure that the discussion is concise and follows this overall structure – sub-headings are not needed:

- Statement of principal findings
- Strengths and weaknesses of the study
- Contribution to the body of knowledge
- Strengths and weaknesses in relation to other studies
- The meaning of the study – e.g. what this study means to clinicians and policymakers
- Unanswered questions and recommendations for future research

Conclusions

This may be the only section readers look at, therefore write it carefully. Include primary conclusions and their implications, suggesting areas for further research if appropriate. Do not go beyond the data in the article.